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CONTENTS.

FOREWORD.

In the present number of the Journal will be found the final deductions derived from two sets of trials each of which has run its full three years course. The County Spring Oat Trials represent the most ambitious endeavour so far made in Britain to obtain country-wide co-operation in yield trials, and although the call for national economy severely restricted this co-operation and thus seriously curtailed the number of reliable deductions which it was possible to draw, there can be no doubt that given more extensive participation, a scheme of this nature can and will give results of great general value to farmers.

The Institute's own Winter Oat Trials illustrate the impossibility of discovering the merits and defects of new varieties without comprehensive testing on scientific lines. Only after the collection and consideration of the full data set out in this report was it possible to decide that the variety 136/17, now known as " Resistance ", would be an asset to the agricultural world.

For the first time the pea crop figures among those reported on; this deals with preliminary work on this crop and further trials are in progress.

The rest of the contents of this number require no comment. That no further addition is made to the exposition of the Institute's Methods of Trial and that previous sections are not reprinted as usual needs some explanation. When the section in question was begun it had seemed that further improvement in methods was at least not imminent, and that comparative stability had been reached; experience has, however, shown that in this, as in other matters, the Institute could not stand still. Although the methods hitherto described have well fulfilled their purpose, improvements are continually suggesting themselves and are being tried out. Material modifications of method will from time to time be expounded in the Journal as they prove themselves, but the time is not ripe for a full and final description of the testing methods used for each crop.

The Institute wishes to express its gratitude to the Director and staff of the Agricultural Institute, Kirton, for carrying out yield trials of peas and potatoes and of the Northumberland County Demonstration Farm, Cockle Park, for conducting trials of winter oats; also to the North of Scotland College of Agriculture, the Institute for Plant Breeding, Wageningen, the Svalof Plant Breeding Institute and the Institute of Agricultural Botany, Braunschweig, for testing the winter oat varieties for frost resistance, and to Mr. C. J. Mapey for valuing oat samples derived from the yield trials.

The trials at the Institute's Headquarters Trial Grounds, Ormskirk, and the five sub-stations are supervised as follows :—

Cambridge : by Mr. S. F. Armstrong, Manager of Field Plots, assisted by Mr. E. G. Thompson, Mr. B. Brandreth and Mr. T. W. Stops.

Ormskirk :	by Mr. H. Bryan, Superintendent of Potato Trials, assisted by Mrs. McDermott.
Cannington :	by Mr. G. E. Furse, Crop Recorder.
Long Sutton :	by Mr. A. J. Marval, Crop Recorder.
Newport :	by Mr. H. E. F. Maddrell, Crop Recorder.
Sprowston :	by Mr. W. Rimmer, Crop Recorder.
Askham Bryan :	by Mr. H. W. Simmons, Crop Recorder.

(Signed) WILFRED H. PARKER.

December, 1935.

COUNTY SPRING OAT TRIALS, 1931-1933

B. BRANDRETH, B.A.

The series of trials under review constitutes the first serious attempt to bring into being a co-ordinated system of crop variety trials on a national scale. The results attained fall short of what might be expected from later work of the same sort, but it is hoped that the experience gained will lead to improvements in method and to an extension of the trials to include other crops.

There can be no doubt as to the demonstration value of the trials, for not only can the varieties be compared by farmers in the field, but growers can also see for themselves the value of sowing clean seed of high germinating capacity obtained from reputable firms. In the three years covered by the trials 60 tons of seed have been distributed to growers, and this alone should have provided a basis for improving the average quality of seed oats.

The trials will be criticized by growers and others on the grounds that they provide little new information and that the results are indefinite. As to the first, they at least demonstrate that the varieties tested behave very similarly under a wide range of conditions in many parts of England and Wales. They also provide confirmation of the results obtained in field trials conducted by the National Institute of Agricultural Botany at Cambridge and its five sub-stations.

The lack of precision in the results must be attributed to the reduction in the number of centres consequent on the financial crisis of 1931 and the economy campaign which followed. In trials of this type the probability of obtaining statistically significant results must depend on a large number of single plot trials or on a uniform degree of replication at a smaller number of centres. The latter is the preferable alternative, but presents greater difficulties in supervision. The greater demonstration value of a larger number of single plot trials cannot be overlooked, and it seems likely that they will offer better prospects of expansion. The value of the trials would be greatly enhanced if they were continued from year to year on the same farms, or at least in the same districts. In this way the difficulties due to lack of replication might to some extent be overcome.

The trials of spring oats have been continued in 1934 and 1935, the varieties included being Golden Rain II, Eagle and Star, produced by the Svalof Plant Breeding Institute, and Progress, bred by Gartons of Warrington. The number of centres at which trials have been arranged has increased, seventy trials having been sown in 1935. It is proposed to commence trials of winter oats in the autumn of 1935 and the varieties Grey Winter and Resistance and two new productions of the Welsh Plant Breeding Station have been sown at Cambridge to provide seed.

The chief analyses in the interim reports for 1931 and 1932 were carried out at Rothamsted through the courtesy of Dr. R. A. Fisher and Mr. F. Yates, whose assistance is gladly acknowledged.

The statistical handling of the results has been greatly simplified by the co-operation of the staff of the Cambridge University School of Agriculture,

and in particular, of Drs. H. G. Sanders and J. Wishart, who have elucidated many points during the progress of the trials and have been good enough to read through the draft of this report and to make suggestions as to its final form.

The Institute wishes to take this opportunity of expressing its appreciation of the help thus rendered.

INTRODUCTION.

For many years variety trials of crop plants have been carried out by agricultural colleges, county authorities and other bodies. These trials have usually consisted of single plots of each variety, so that the validity of their results has been reduced by reason of the great amount of variation known to occur in the fertility of the soil of even a small area.

In any case, the findings of the trials were seldom of more than local application, and it was often difficult to assess the merits of a particular strain as compared with more than a very small number of others.

With the inception of the National Institute of Agricultural Botany in 1919, there gradually came into existence a scheme of co-ordinated variety trials, which have now been carried out for some years at all of the Institute's six centres, Cambridge, Good Easter (Essex), Cannington (Somerset), Long Sutton (Hants.), Newport (Salop), and Sprowston (Norfolk). Varieties are grown simultaneously at these centres, first in small observation plots and later, should they show sufficient merit, in properly replicated field trials. The latter are continued for three years.

The same standard variety is grown in every trial of any particular crop and thus the comparative behaviour of the varieties under test can be observed in a number of districts and over several seasons. The chief merit of these trials lies in their co-ordination and continuity.

For some time prior to 1931, an attempt had been made to disseminate the results of the trials of the National Institute of Agricultural Botany by arranging for the growing of demonstration plots of recommended varieties by various authorities throughout Great Britain.

In 1931 an effort was made to extend these plots and to provide the means by which bodies could adapt their trials so as to form a co-ordinated whole on a national basis. The co-operation of county education authorities in England and Wales and also of other bodies was invited in a scheme for testing varieties of spring oats, this being the most generally grown crop. A ready response was obtained, and trials at 109 centres were arranged. It was hoped to continue a similar number of trials for a further two years, but owing to the economic and financial crisis of the autumn of 1931 the extent of the trials suffered severely in 1932 and 1933.

However, comparable trials in many of the counties of England and Wales have been carried out over a period of three years, and it is to be hoped that the experience gained will lead to further co-ordination of all such efforts.

The results of each year have been examined and interim reports sent to all those participating.

The report which follows embodies these interim reports, describes the methods adopted, and gives an analysis of the three years' results.

METHODS AND SCOPE OF THE TRIALS.

The varieties selected for trial were Victory and Golden Rain II, produced by the Svalof Plant Breeding Institute, and Marvellous, bred by Gartons of Warrington.

All who agreed to co-operate in the trials were asked to grow not less than a single one-tenth acre plot of each variety, the plots being of uniform shape and size. The arrangement of the varieties at each centre was left to the discretion of those carrying out the trials.

The seed for the 1931 trials was obtained by the Institute from the producers and distributed to the various centres. For the trials of succeeding years the Institute grew the seed and supplied it at the cost of production to those participating.

The seed rate, time of sowing, and all other details of cultivation were left to be carried out in accordance with local practice, but it was suggested that the seed of Marvellous should, owing to its large size, be sown at the rate of one bushel per acre more than the other varieties.

Record forms were supplied by the Institute and the following particulars were asked for as being essential :—Situation of plots; season; name of variety; area per plot and number of plots of each variety; type of soil and subsoil; altitude; details of cultivation and manuring in the year of trial and in the previous year; dates of drilling, ripening and cutting; seed rate; yields of grain and straw per plot and valuation of the grain; and notes on the vigour of the young plant, the strength of straw and the general economic value of the varieties.

Those who signified their willingness to give further particulars were provided with an extended questionnaire including the following: Records of rainfall, sunshine and accumulated temperatures; direction of drilling; dates of brairding and ear emergence; amount of tillering; habit of young plants; notes on resistance to disease; and notes on type of straw and quality of grain. Very little of this supplementary information was obtained, and the more extensive record form was eventually dropped. In fact, as will be seen from the analyses of the data, a large number of centres were unable even to supply the whole of the particulars required on the simpler basis.

It was realised that yield results from single plots would be quite unreliable if taken by themselves. Their value could lie only in the combined results obtained from a number of centres in each county or group of counties. Replicated plots were grown at a number of centres in 1931, but in this and in succeeding years the majority of trials were made up of single plots. It became clear that no uniform measure of replication could be attained, and in these circumstances it seemed advisable to encourage an increase in the number of single plot trials. Although replication provided a better estimate of the yield at the centre where it was carried out, there were difficulties in the way of taking account of it in the statistical analysis of results coming from trials made up of one-, two- and three-plot layouts. In the analyses the average yield per acre of all the replications in any one trial has been used rather than the yield of a single replication taken at random.

The number of trials which were arranged in each year was as follows :

1931	109	(in 42 counties)
1932	58	(,, 27 ,,)
1933	53	(,, 29 ,,)

Some idea of the degree of replication may be gathered from Table I, which also shows the number of trials from which more or less complete records were obtained, together with the average size of plot. In 1931 this varied from 1/10th acre up to nearly 2 acres, but it became more uniform in the 1932 and 1933 series. Uniformity of the size of plot is clearly desirable, and efforts to ensure a standard size of plot have been made in subsequent years.

Table I.

	1931	1932	1933
Number of recorded trials	93	51	41
Total number of plots	145	80	60
Average area of plots (acres)...	0·412	0·445	0·456

It will be seen that out of 220 trials 35, or 16 per cent., yielded no results that could be used in the general analysis. The crops at eleven centres were failures, the trials at twelve centres failed to include all of the three varieties, and no varietal data was obtained from the remaining twelve centres.

Of the 185 series of records which were received, many consisted of yield figures only, while a large proportion were more or less incomplete. Owing to the difficulty experienced in obtaining many of the particulars, certain of the analyses are based on a comparatively small number of returns.

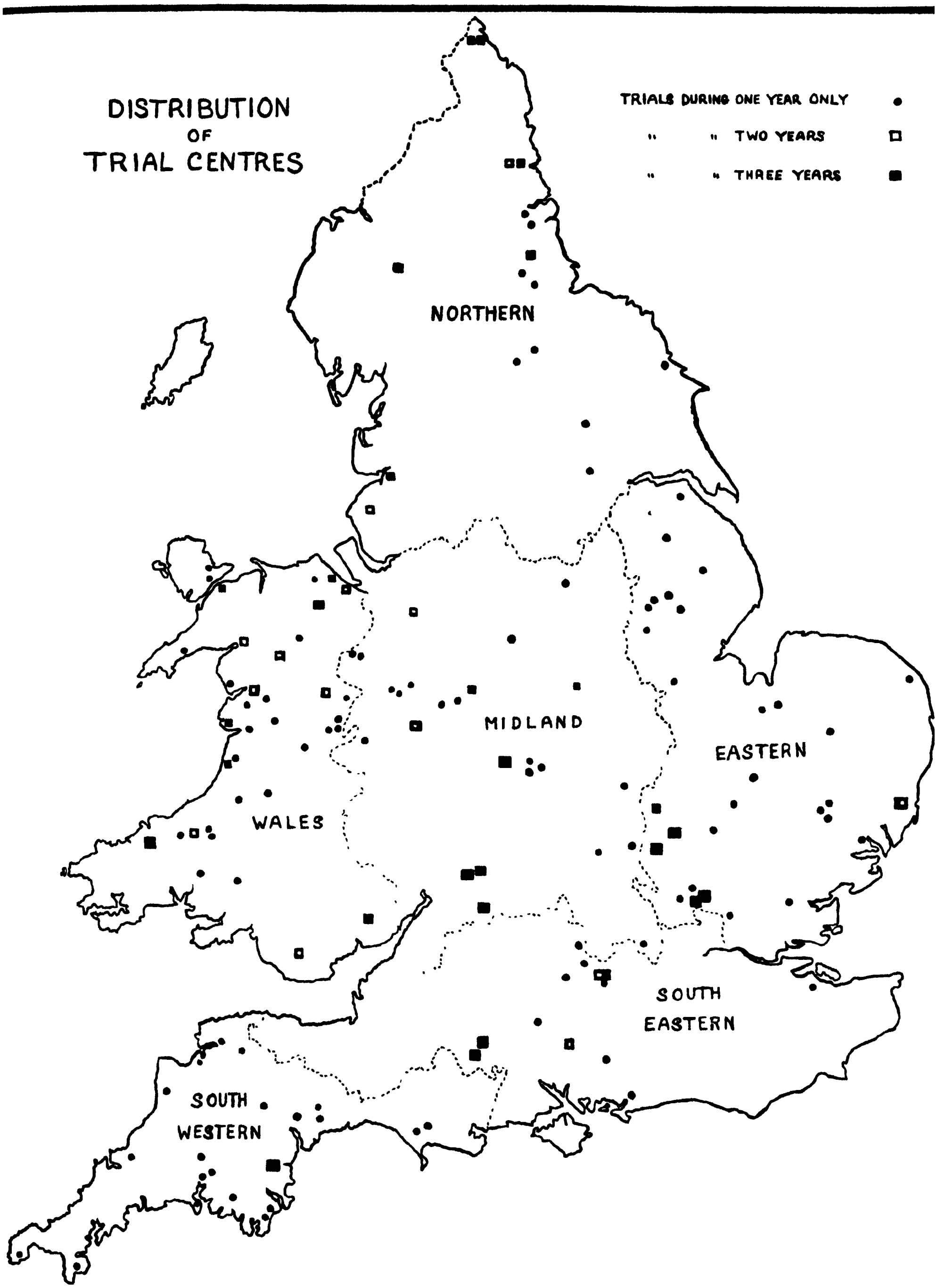
The interim reports which have been issued on the completion of each year of the trials have been concerned with the yields of grain. This final report summarizes the three years' records of yield and also of such other features as were sufficiently recorded.

It had been hoped that each trial might have been continued from year to year, if not on the same farm, at least in the same district. This was not possible in more than a small minority of cases, and owing to the lack of continuity the effect of season cannot properly be considered.

It should be noted here that the yield of grain is the only feature which has been examined on the basis of single years. The number of other records in any one year was generally small, and results from the three years have accordingly been bulked, each trial being considered as a separate record, although in some cases carried out on the same farm in each of the three years.

A list of centres and growers will be found on pages 10 - 13, together with a list of the counties forming the sections into which the country was divided for the purposes of the trials. Wherever possible the trials were grown by Institutions and by County Agricultural Organizers on their experimental farms; where this was impossible, arrangements were made with farmers on suitable land, who carried out all the necessary operations. The drilling and harvesting of small plots is tedious work, and occupies valuable time at busy seasons of the year, and the thanks of the Institute are due to all those who contributed to the success of the trials.

The distribution of trial centres may be gathered from the outline map on page 9, which also shows the sections into which the country was divided.


DISTRIBUTION
OF
TRIAL CENTRES
TRIALS DURING ONE YEAR ONLY
" " TWO YEARS
" " THREE YEARS
NORTHERN
MIDLAND
EASTERN
WALES
SOUTH
EASTERN
SOUTH
WESTERN

TRIAL CENTRES.

NORTHERN SECTION.

Cumberland	Newton Rigg, Penrith	Cumberland and Westmorland Farm School	1931, 1932, 1933
Durham	Bishop Auckland	W. Birkitt	1931
	Chester-le-Street	J. R. Spraggon	1931
	Tantobie	J. Wallison	1931
	Houghall	J. Wilson	1931, 1932, 1933
	Heighington	A. Simpson	1933
Northumberland	Ford Hill, Berwick-on-Tweed	Major the Hon. J. A. Joicey	1931, 1932, 1933
	Ancroft, Berwick-on-Tweed	J. G. G. Rea	1931, 1932, 1933
	Morpeth	Messrs. J. & J. W. Frater	1931, 1932
	Cockle Park Experimental Farm	Northumberland County Council	1931, 1932, 1933
Yorkshire	Thornton Watlass	M. Hammond	1931
	Askham Bryan	C. M. Knight	1931
	Northallerton	W. T. Kirby	1931
	Selby	J. Tate	1931
	Wykeham	W. Robinson	1931
Lancs.	Ormskirk	Potato Testing Station	1932, 1933
	County Council Farm, Hutton	Lancs. County Council	1931, 1932, 1933

MIDLAND SECTION.

Derby	Shirebrook	H. Clayton	1931
	Marston Montgomery	H. Prince	1931
Leicester	Sutton Bonington	Midland Agricultural College	1931, 1932, 1933
Northampton	County Farm Institute, Moulton	Northamptonshire County Council	1931
Bucks.	Preston Bissett	A. E. Bryant	1931
	Haversham	F. Massey	1931
	Marlow	H. Darvill	1931
Gloucester	Cirencester	Royal Agricultural College	1931, 1932, 1933
	Upper Slaughter	Col. E. P. Brassey	1931, 1932, 1933
	Andoversford	J. C. Meikle	1931
	Andoversford	T. C. Hyatt	1932, 1933
Salop	Shifnal	J. Bowen	1931
	Lydbury North	S. Norton	1931
	Montford Bridge	G. Warner	1931
	Bridgnorth		1932
	Bridgnorth	E. Turner	1933
	Aston-on-Clun		1932
	Oswestry		1932
	Hadnall	J. Fairhurst	1933
	Shrewsbury	R. J. H. Edwards	1933
Staffs.	The Farm Institute, Penkridge	Staffordshire County Council	1931, 1932, 1933
	Pattingham	P. L. Oliver	1931
Warwick	Studley	Studley College	1931, 1932, 1933
	Heathcote	R. G. Richmond	1932, 1933
	Wellesbourne	Major A. D. Clarke	1932
	Stratford-on-Avon	Capt. A. R. West	1933
Cheshire	Reaseheath School of Agriculture	Cheshire County Council	1931, 1933

EASTERN SECTION.

Bedford	Cople	W. L. Porter	1931, 1932, 1933
	Woburn	E. B. Watson	1931, 1932, 1933
	Harrold	Messrs. Northern & Son	1931, 1932, 1933
Cambridge	Trumpington	R. J. Cornwell	1931
	Steeple Morden	S. Kirby	1931
	Soham	W. Smith & Son	1931
Essex	Nazeing, Waltham Cross	G. Chapman	1931
	West Hanningfield, Chelmsford	T. H. Sochon	1931
Herts.	Herts. Institute of Agriculture, St. Albans	Herts. County Council	1931, 1932, 1933
	Hemel Hempstead	F. J. Elworthy	1931
	St. Albans	F. W. Dean	1931
	Harpenden	Rothamsted Experimental Station	1931
Lincs. (Lindsey)	Panton, Wragby	A. W. Noble	1931
	Ulceby	H. Mollett	1932
	Snitterby	J. W. Cottingham	1933
Lincs. (Kesteven)	Billinghay	F. Toulson	1931
	Stragglethorpe	L. E. Allbones	1931
	Eagle	A. Harley	1932
	North Kyme	J. R. Wright	1932
	Thurlby	Griffin & Sons	1933
	Swinderby	G. H. Newton	1933
Norfolk	Nordelph	W. Proctor	1931
	Boughton	E. Marks	1931
	Bridgham	J. R. Ware	1931
	Catfield	H. P. E. Neave	1931
Suffolk, East	Tunstall	G. Thurston	1931, 1932
	Chelmondiston	S. Cordle	1933
Suffolk, West	Gt. Barton	West Suffolk County Council	1931
	Fornham St. Martin	Lt.-Col. G. H. Long	1933
	Cockfield	West Suffolk County Council	1933

SOUTH EASTERN SECTION.

Kent	Tunstall, Sittingbourne	Kent County Council	1931
Sussex, West	Chichester	West Sussex County Council	1931
Berks.	Shinfield	Reading University Farm	1931, 1932, 1933
	Newbury	H. C. Sutton	1931
	Moulsford	Berks. Mental Hospital	1931
	Shinfield	National Institute for Research in Dairying	1931, 1932
	Swallowfield	G. Dance	1932
	Streatley	O. J. Bishop	1933
Hampshire	Sparsholt	Farm Institute	1931, 1933
	Andover	C. S. Lovelock	1931
	Petersfield	Col. R. F. N. Baxendale	1931
Isle of Wight	Shorwell	J. Attrill	1931
	Newchurch	C. Allen	1931
	Thorley	E. G. Heal	1932, 1933
Middlesex	Napsbury Mental Hospital	Middlesex County Council	1931, 1932, 1933
Wilts.	Teffont	Messrs. Crouch & Sons	1931, 1932, 1933
	Wylye	Capt. F. N. Jeans	1931, 1932, 1933

SOUTH WESTERN SECTION.

Dorset	Forston Grange, Dorchester	A. P. Goddard	1931
	Chesilbourne, Dorchester	R. E. Bennett	1931
Cornwall	Gorran	Mr. Mitchell	1931
	Kirkhampton.	Mr. Timms	1931
	Millbrook	Mr. Rundle	1931
	St. Buryan	F. Hosking	1931
	St. Tudy	Mr. Button	1931
Devon	Newton Abbot	Seale Hayne Agricultural College	1931, 1932, 1933
	Stoke Canon	H. L. I. Horrell	1931
	Stoke Fleming	J. E. Forster	1931
	Ottery St. Mary	J. Peek	1931
	Bideford	T. Trewin	1931
	Tavistock	J. Willcock	1931
	Copplestone	H. Parr	1932
	Yelverton	S. Ward	1932
	Barnstaple	J. D. Andrew	1932
	Ivybridge	A. J. Abbot	1932
	Slapton	J. Honeywill	1933
	Payhembury	H. Daniels	1933
	Buckland	S. M. Ward	1933
	Filleigh	W. F. J. Pidler	1933

WALES AND MONMOUTH.

Anglesey	Parciau, Marianglas	Col. L. Williams	1931
	Plashewydd, Llanfair P.G.	The Marquis of Anglesey	1931
Caernarvon	Madryn Farm School, Bodfean	Caernarvonshire County Council	1931, 1932
	Bangor School of Agriculture	University College of North Wales	1931, 1932, 1933
Cardiganshire	Glynarthan, Henllan	J. J. Owen	1931
	Beulah	T. Thomas	1931
	Llandyssul	Mr. Davies	1931, 1932
	Beilicardarn, Llanwren	J. Evans	1931
	Aberystwyth	University College of Wales	1931, 1932, 1933
	Maesycrugiau	Mr. Lloyd	1932
	Capel Seion	W. G. Rattray	1932
	Llangeitho, Tregaron	Mr. Jones	1932
Denbigh	Llysfasi Farm Institute, Ruthin	Denbighshire County Council	1931, 1932, 1933
Flints	Lloc, Holywell	J. Hughes	1931, 1932, 1933
	Liscwm	G. Kendrick	1931, 1932
	Bryncoch	D. T. Pierce	1933
Carmarthen	Pibwrlwyd Farm Institute	Carmarthen County Council	1931
	Gwynefe, Llangadock	G. Jones	1931
	Llanfihangel-yr-arth	J. I. Davies	1931
Glamorgan	Demonstration Farm, Pencoed	Glamorgan County Council	1931, 1933
Merioneth	Dolgelley	J. Price	1931, 1932
	Towyn	W. Jones	1931, 1932, 1933
	Llanfihangel-y-Pennant	H. Vaughan	1931
	Bala	D. M. Davies	1931, 1932
	Mallwyd	J. Jones	1931
	Maenturog	W. Pierce	1932
	Maenturog	W. Owen	1933
	Corwen	T. Roberts	1933
	Dyffryn	M. Griffith	1933

Montgomery	Llanidloes	Mr. Owen	1931
	Cefncoch	E. Jones	1931
	Llanfair	Mr. Jones	1931
	Llanbrymair	Mr. Rowlands	1931
	Berriew	J. Bowen	1932
	Churchstoke	E. Rees	1932
	Llanfair	Messrs. Jones	1933
	Sarn, Newtown	Mr. Jandrell	1933
Pembroke	Cilwendeg, Boncath	W. Bowen	1931, 1932, 1933
Monmouth	Monmouth Agricultural Institute, Usk	Monmouthshire County Council	1931, 1932, 1933

YIELD OF GRAIN

1931

The average yields of grain calculated from the returns of the 93 centres in England and Wales at which all three varieties were grown were as follows :

Golden Rain II	21·49	cwt. per acre
Marvellous	20·67	,, ,, ,,
Victory	20·82	,, ,, ,,
S.E. of mean	0·24	,, ,, ,,

A difference of three times the standard error may be regarded as significant, so that Golden Rain II significantly outyielded Marvellous. Its superiority over Victory just escaped significance.

The behaviour of the three varieties in the different sections of the country is given in Table II.

Table II.

TOTAL YIELD OF GRAIN, 1931.

Section	No. of returns	Average yield of grain (cwt. per acre)			
		Golden Rain II	Marvellous	Victory	S.E. of mean
Northern	15	23·43	22·66	22·51	0·598
Midland	12	21·12	21·94	21·13	0·669
Eastern	17	23·26	22·78	22·78	0·562
South Eastern ...	12	22·69	21·33	22·35	0·669
South Western ...	9	21·61	18·51	20·68	0·772
Wales & Monmouth ...	24	20·35	19·74	19·29	0·475

None of these differences was significant except that between Golden Rain II and Marvellous in the South Western district.

N.B.—All figures are for total yields of grain. It was seldom possible to obtain records of the amount of head and tail corn.

1932.

The demand for national economy in the autumn of 1931 caused a serious reduction in the extent of the trials; returns were received from 51 centres and average yields from these were :—

Golden Rain II	25·70	cwt.	per	acre
Marvellous	24·68	,,	,,	,,
Victory	24·30	,,	,,	,,
S.E. of mean	0·28	,,	,,	,,

Golden Rain II this year significantly outyielded both Marvellous and Victory.

Grouped under the regional sections the average yields were as shown in Table III.

Table III.

TOTAL YIELD OF GRAIN, 1932.

Section	No. of returns	Average yield of grain (cwt. per acre)			
		Golden Rain II	Marvellous	Victory	S.E. of mean
Northern ...	6	28·30	27·70	27·75	0·845
Midland ...	9	24·26	23·53	21·73	0·691
Eastern ...	7	24·18	22·54	23·37	0·784
South Eastern	7	27·01	24·83	25·82	0·784
South Western	4	29·66	27·81	26·30	1·035
Wales & Monmouth	18	24·73	24·31	23·74	0·488

In this year Golden Rain II significantly outyielded Victory in the Midland and South Western sections, but no other difference was significant.

1933.

The number of trials arranged showed a further diminution. From the returns received from 41 centres the following average yields were calculated :

Golden Rain II	23·50	cwt.	per	acre
Marvellous	22·78	,,	,,	,,
Victory	22·68	,,	,,	,,
S.E. of mean...........	0·38	,,	,,	,,

Although, as in the previous years, Golden Rain II gave a higher average yield than the other varieties, this year the difference was not significant. It was clear that the number of centres from which returns were received was so small that detection of small differences was unlikely.

The average yields from the trials in the different sections are given in Table IV.

Table IV.

TOTAL YIELD OF GRAIN, 1933.

Section	No. of returns	Average yield of grain (cwt. per acre)			
		Golden Rain II	Marvellous	Victory	S.E. of mean
Northern	7	28·28	27·79	27·12	0·982
Midland	9	24·38	24·27	24·04	0·952
Eastern	7	18·05	18·22	18 04	0·493
South Eastern ...	6	16·85	17·10	16·53	0·890
South Western ...	4	25·59	21·24	22·89	1·374
Wales & Monmouth ...	11	26·06	24·94	24·99	0·725

Here again it will be seen that none of the differences reached the level of significance.

1931-32-33.

The comparative yields from the three varieties, when the three seasons' results are taken together, are given in Table V.

Table V.

AVERAGE YIELD OF GRAIN IN ALL TRIALS.

Section	No. of returns	Average yield of grain (cwt. per acre)				
		Golden Rain II	Marvellous	Victory	S.E. of mean	Significant difference
Northern ...	28	25·69	25·02	24·78	0·504	1·46
Midland ...	30	23·04	23·12	23·18	0·485	1·37
Eastern ...	31	21·98	21·39	21·49	0·368	1·04
South Eastern	25	21·98	20·69	21·27	0·424	1·17
South Western	17	22·70	19·81	21·50	0·434	1·25
Wales & Monmouth	53	23·15	22·51	22·10	0·279	0·77

In the Northern, Midland and Eastern sections of England the three varieties gave practically identical average yields of grain, the differences in no case exceeding 4 per cent.

In the South Eastern and South Western sections Golden Rain II outyielded Marvellous by 6·2 per cent. and 14·6 per cent. respectively, Victory taking an intermediate position.

In Wales Golden Rain II outyielded Victory by 4·8 per cent. and this difference was statistically significant; Marvellous and Victory gave similar yields.

Although differences of less than 5 per cent. are of little practical value, it is noteworthy that a comparatively high degree of precision can be attained in this type of trial where, as in the case of Wales, results can be obtained from a large number of centres.

Taking the results as a whole, it will be seen that Golden Rain II tends to give a higher total yield than Victory or Marvellous, and that the latter give very similar yields.

It is very unfortunate that it was in most cases impossible to obtain figures showing the comparative yields of head- and tail-corn. Where these were obtained and where the same screens were used for the three varieties it was clear that Golden Rain II produced a higher proportion of tail-corn than either Marvellous or Victory. This would be overcome to some extent by the use of a smaller screen, but it is doubtful whether as large a yield of saleable grain could ever be obtained from Golden Rain II as from the other varieties. While this must, under present conditions, reduce the market value of Golden Rain II, it actually increases its value for feeding purposes, for the husk content of tail-corn, in so far as it consists of well filled grains, is lower than that of head-corn.

In further considering the yield of grain, the centres have been classified on the basis of type of soil, date of sowing, rate of sowing and apparent fertility. The value of these classifications is somewhat doubtful, for in trials of this nature there is no means of balancing the various factors contributing to the growth of the crop. What may be a factor limiting growth in one trial may be of small account in another. All that can be ascertained is the behaviour of the varieties at the centres included in any particular class.

Care must be taken in interpreting the results to make varietal comparisons only. On account of the small number of trials forming the different sections of each classification, no other form of comparison would be justified. For example, the average yields from light soil centres were greater than from those on heavier soils, but it must not be inferred from this that light soils are necessarily better suited to the spring oat crop than heavy.

The number of centres in 1932 and 1933 was too small to allow of useful subdivision, and the returns from the three years have generally been bulked. Except where a year is mentioned, the results given and the conclusions reached are on the basis of the whole of the three years' trials.

DATE OF SOWING AND TYPE OF SOIL.

The average dates of sowing for each section are given in Table VI.

Table VI.

AVERAGE DATE OF SOWING.

Centres	1931	1932	1933	1931-1933
Northern	Mar. 28	Mar. 26	Mar. 23	Mar. 26
Midland	Mar. 21	Mar. 3	Mar. 18	Mar. 14
Eastern	Mar. 15	Feb. 27	Mar. 27	Mar. 14
South Eastern ...	Mar. 21	Mar. 8	Mar. 12	Mar. 15
South Western ...	Mar. 23	Mar. 7	Mar. 25	Mar. 20
Wales & Monmouth ...	Apr. 7	Apr. 4	Mar. 31	Apr. 5

The centres were divided into three groups :—

1. Early. Sown five or more days earlier than the average date for the district.
2. Normal. Sown during the period four days before, up to and including five days after the average date for the district.
3. Late. Sown six or more days later than the average date for the district.

England.

Examination of the data showed that in all districts the centres were sown later when on heavy than when on light soil. Time of sowing has therefore been considered in relation to type of soil.

The average yields of grain over the three years from centres sown during each of the three periods are given in Table VII.

Table VII.

DATE OF SOWING AND TYPE OF SOIL (ENGLAND).

Date of sowing	Soil		Average yield of grain (cwt. per acre)			
			Golden Rain II	Marvellous	Victory	Significant difference
Early	Light	(19)	23·11	21·36	22·93	1·65
	Medium	(16)	24·40	24·02	23·68	1·67
	Heavy	(7)	18·88	18·29	18·99	1·36
Normal	Light	(13)	22·68	21·85	23·23	1·97
	Medium	(24)	24·00	23·73	23·18	1·24
	Heavy	(14)	22·48	21·03	19·79	2·20
Late	Light	(8)	24·21	23·33	21·90	2·13
	Medium	(18)	23·09	22·34	22·41	1·66
	Heavy	(11)	21·94	20·24	21·08	1·90

At the early sown centres on light soils Golden Rain II outyielded Marvellous by 8·2 per cent. Similarly, Golden Rain II outyielded Victory by 13·6 per cent. at heavy soil centres sown on or around the average date and on light soil at late sown centres by 10·6 per cent. Other differences were small and were not statistically significant.

There is no evidence of differential behaviour with regard to either date of sowing or type of soil. The superiority in yield of Golden Rain II is maintained and in no case is there any significant difference between the total yields of Marvellous and Victory.

N.B.—Throughout this report, figures in brackets refer to the number of returns on which average figures are based.

Wales and Monmouth.

There was comparatively little variation in the types of soil on which trials were grown in Wales, and there was no evidence that differences in soil type influenced the date of sowing.

Time of sowing and soil type are therefore considered separately and the average yields of grain over the three years will be found in Tables VIII and IX.

Table VIII.

DATE OF SOWING (WALES AND MONMOUTH).

Date of sowing		Average yield of grain (cwt. per acre)			
		Golden Rain II	Marvellous	Victory	Significant difference
Early	(18)	24·79	24·13	23·40	1·33
Normal	(10)	22·10	21·37	22·18	1·57
Late	(23)	21·78	21·19	20·69	1·27

Golden Rain II outyielded Victory by 5·9 per cent. at the early sown centres, but no other difference was significant. The relative yields of the varieties were much the same whatever the time of sowing.

Table IX.

TYPE OF SOIL (WALES AND MONMOUTH).

Type of soil		Average yield of grain (cwt. per acre)			
		Golden Rain II	Marvellous	Victory	Significant difference
Light	(21)	22·97	21·13	20·80	0·90
Medium and heavy	(31)	23·28	23·44	22·98	0·56

As only two trials were grown on heavy soil, these have been included with the centres on medium soils.

Golden Rain II outyielded Victory by 10·4 per cent. and Marvellous by 8·4 per cent. on the lighter soils, but no other difference was significant.

As in the case of the English centres, there was no evidence of differential response of the varieties either to time of sowing or type of soil.

RATE OF SOWING.

It has been mentioned that growers were asked to sow Marvellous at the rate of one bushel per acre more than the other varieties. At some centres each variety was sown at the same setting of the drill and at others the actual weight of seed sown was the same for each, but at the majority of centres

roughly equal weights of seed of Victory and Golden Rain II were sown, with Marvellous at a bushel or half a bushel per acre more.

Seed rates for Victory and Golden Rain II varied between $2\frac{3}{4}$ and $7\frac{1}{4}$ bushels per acre in England and between $2\frac{1}{2}$ and $6\frac{1}{2}$ bushels per acre at the Welsh centres, the majority of trials being sown at 4 bushels and $5\frac{1}{4}$ bushels per acre respectively.

The yields of grain from centres sown at high and low seed rates are given in Table X.

Table X.

RATE OF SOWING.

Seed rate	Average yield of grain (cwt. per acre)		
	Golden Rain II	Marvellous	Victory
England			
4 bus. per acre and less (70)	22·38	21·79	21·58
Over 4 bus. per acre (56)	23·53	22·30	22·92
Wales and Monmouth			
5 bus. per acre and less (19)	21·20	20·76	20·89
Over 5 bus. per acre (29)	23·40	22·34	22·02

Although the differences between varietal yields are small, they exhibit the same trend as in earlier analyses, Golden Rain II outyielding Marvellous and Victory, which themselves have similar yields. There is no evidence that the rate of sowing affects the relations between the yields of the varieties.

In Wales, and to a lesser extent in England, the centres sown at a higher seed rate produced decidedly heavier crops than those sown at a lower seed rate. In view of the large number of trials concerned, this is worthy of interest, although it should be observed that other factors, the effect of which cannot be estimated, may have contributed to this result.

APPARENT FERTILITY.

There were indications from the 1931 results that the level of fertility had some effect on the relations between the varietal yields. Such effects were, however, lacking from the 1932 and 1933 results, and as will be seen from Table XI, whatever the actual mean yield, the relative yields were very much the same.

In the absence of any other means of estimating the general level of fertility the centres were classified according as to whether the mean yield per acre of the three varieties was below 20 cwt., between 20 cwt. and 24·99 cwt., and 25 cwt. or more. There is no evidence that the apparent fertility of the centres had any differential effect on yield.

Table XI.

EFFECT OF APPARENT LEVEL OF FERTILITY.

Mean yield of all varieties		Average yield of grain (cwt. per acre)		
		Golden Rain II	Marvellous	Victory
England				
Under 20 cwt. per acre	(46)	16·61	15·85	15·75
Between 20 and 24·99 cwt. per acre	(45)	22·85	22·23	22·17
25 cwt. per acre and over	(42)	30·46	29·11	29·62
Wales and Monmouth				
Under 20 cwt. per acre	(25)	18·00	17·13	17·57
Between 20 and 24·99 cwt. per acre	(9)	23·68	21·65	21·54
25 cwt. per acre and over	(18)	30·04	30·39	28·67

STRAW.

It will be seen from Table XII that Golden Rain II and Victory generally produced similar amounts of straw and that both tended to outyield Marvellous in this respect.

Table XII.

YIELD.

		Average yield of straw (cwt. per acre)		
		Golden Rain II	Marvellous	Victory
England				
1931	(34)	28·55	25·67	29·09
1932	(14)	29·85	28·96	28·65
1933	(15)	20·91	18·01	22·75
Wales and Monmouth				
1931	(17)	31·66	29·89	32·03
1932	(12)	29·23	28·00	27·94
1933	(9)	30·63	27·69	30·34

STANDING POWER.

The amount of lodging in each variety was recorded by a system of marks, "O" indicating that no lodging occurred and "4" denoting a completely laid crop.

In 1931 the majority of plots in all districts was more or less laid, although the extent of lodging was generally small. In the northern and midland districts, where it was more serious, it was clear that Golden Rain II resisted lodging rather better than the other varieties. In other parts of England and in Wales varietal differences in this respect were small and somewhat inconsistent.

Little lodging occurred at any of the centres in England in 1932 or 1933; some of the Welsh plots were laid in 1932, but very few in 1933. Varietal differences were small, and it is clear that in the absence of any degree of serious lodging there is little possibility of differentiating between the standing power of varieties.

Table XIII shows the averages of the marks awarded to the varieties at all of the plots in England and Wales respectively. Although the amount of lodging was greater in some districts than others, the varietal incidence was similar and the figures have accordingly been grouped under the headings of England and Wales.

Table XIII.

AMOUNT OF LODGING.

	Number of returns	Percentage of centres recording lodging	Average marks awarded		
			Golden Rain II	Marvellous	Victory
England					
1931	63	65	0·76	0·95	1·05
1932	31	55	0·76	0·72	0·65
1933	27	33	0·34	0·31	0·39
Wales and Monmouth					
1931	22	95	1·87	1·87	2·05
1932	18	78	1·17	1·28	1·06
1933	7	43	0·71	0·14	0·14

VALUATION OF GRAIN.

Wherever possible, samples of the grain were valued locally and in some cases the actual prices received for the grain were recorded. Roughly half the centres were able to supply this information, which is summarized in Table XIV.

Table XIV.

VALUATION OF GRAIN.

Section	No. of returns	Average value per cwt. (shillings and pence)			
		Golden Rain II	Marvellous	Victory	mean
1931					
Northern	9	7/4	7/4	7/5	7/4
Midland	7	6/8	6/9	6/9	6/9
Eastern	11	6/6	6/4	6/11	6/7
South Eastern ...	8	6/10	7/1	7/2	7/-
South Western ...	6	8/-	7/3	8/1	7/9
Wales & Monmouth	7	7/2	6/6	7/3	7/-
All districts ...	48	7/1	6/10	7/3	7/1
1932					
Northern	5	5/4	5/3	5/4	5/4
Midland	7	6/7	6/7	6/8	6/7
Eastern	6	6/4	5/9	6/7	6/3
South Eastern ..	6	6/4	6/4	6/8	6/5
South Western ...	4	6/9	6/5	6/9	6/8
Wales & Monmouth	10	6/9	6/7	6/10	6/9
All districts ...	38	6/4	6/2	6/6	6/4
1933					
Northern	5	5/3	5/2	5/3	5/3
Midland	7	6/-	6/2	6/7	6/3
Eastern	5	6/8	6/8	6/9	6/8
South Eastern ..	4	6/1	6/2	6/3	6/2
South Western ...	1	a	a	a	a
Wales & Monmouth	6	6/6	6/5	6/7	6/6
All districts ...	27	6/1	6/1	6/3	6/2

(a) It is felt that inclusion of a single set of valuations might be misleading.

In all districts somewhat higher prices were offered for Victory than for Golden Rain II, and the latter was valued much the same as Marvellous, although slightly higher in some districts.

The fall in prices between 1931 and 1933 will be observed and it will be noted that the prices offered at northern centres, which in 1931 were comparatively high, were decidedly lower than the average for the country in 1932 and 1933.

It is not possible to compute the returns to the farmer that each variety would be likely to yield. It seems probable, however, that the higher prices offered for Victory, in conjunction with the fact that it gives a larger proportion of headcorn than Golden Rain II, should render it at least as profitable as the latter variety and probably more saleable, for a white will frequently be preferred to a yellow oat, in spite of its slightly higher price. The higher feeding value of Golden Rain II has been referred to under " Yield of grain."

SUPPLEMENTARY VARIETIES.

A number of additional varieties were grown in each year at certain of the centres and in 1933 Star was included as a principal variety. The number of returns was generally too small to justify statistical handling, but standard errors have been calculated for the differences between the yields of grain of certain of the varieties and of the mean of the yields of the principal varieties. The practice of including additional varieties leads to a spacing out of the chief varieties and it is clear that this disadvantage is not outweighed by the information obtained.

The names of the varieties, together with their yields, will be found in Table XV. This also shows the amount by which each variety exceeds or falls short of the mean yield of the three principal varieties at the centres in question. Significant differences are given in heavy type.

Table XV.

YIELDS OF GRAIN OF SUPPLEMENTARY VARIETIES.

Variety	Number of centres at which grown			Average yield of grain (cwt. per acre)			Difference + or - mean yield of principal varieties (cwt. per acre)		
	1931	1932	1933	1931	1932	1933	1931	1932	1933
Abundance ...	15	4	3	17·93	26·17	16·39	**—3·90**	- 2·22	—2·98
Black Bell III ...	5	1	—	17·09	28·27	—	**—2·16**	+4·73	—
Black Engelbrect	1	—	2	6·50	—	19·40	—	—	+3·20
Black Supreme ...	–	1	—	—	32·75	—	—	—3·17	—
Black Tartarian	8	2	2	14·51	20·37	18·63	—4·31	—7·33	·1·06
Eagle	14	2	1	23·44	23·68	30·53	+1·00	—1·63	+6·78
Earl Haig ...	5		—	15·64	—	—	**—3·91**	—	—
Elder	—	1	2	—	20·31	27·48	-	—6·34	+1·97
Longhoughton ..	4	3	—	12·53	23·28	—	—	**- 6·65**	—
Pure Line Potato	1	8	1	20·13	16·04	26·96		**—3·52**	0·31
Progress ...	9	2	2	22·47	23·36	20·18	+1·04	**—3·99**	1·67
Record	17	10	6	18·39	27·65	26·49	**—2·08**	—0·31	+3·52
Star	23	3	41	19·80	27·12	23·38	—0·62	—4·22	+0·29
Superb	1	1	—	14·50	14·14	—	—	+2·08	—
Supreme ...	10	—	..	19·54		—	+0·11	—	—
Thousand Dollar	4	1	—	19·30	18·18	—	—	+0·14	—
Yielder	2	—	1	22·18	—	22·19	—	—	- 5·08
S.84	—	—	2	—	-	25·54	—	—	+0·03
236/29	—	—	1	·	—	26·34	—	—	—0·93

It will be seen that none of the varieties gave a yield significantly higher than the mean yield of the principal varieties where they were grown. Every significant difference is in favour of the standard varieties. It is possible that certain of the additional varieties possessed advantages which would outweigh their deficiency in yield, but the records were too incomplete to allow of further analysis.

Of the centres at which Record was grown all were in Wales and Shropshire. Its average yield is compared with the average yields of Golden Rain II, Marvellous and Victory in Table XVI. This shows that Record was significantly outyielded by Golden Rain II in 1931, but that the other differences did not reach significance, except in 1933 when Record outyielded Marvellous.

Table XVI.

RECORD.

Season	Number of centres	Average yield of grain (cwt. per acre)				
		Record	Golden Rain II	Marvellous	Victory	Significant difference
1931	17	18·39	21·02	20·59	19·80	2·46
1932	10	27·65	26·76	27·15	25·50	1·93
1933	6	26·49	23·26	21·13	23·29	3·58

SUMMARY.

The spring oat varieties Golden Rain II, Marvellous and Victory, together with supplementary varieties in some cases, were tested at a large number of centres in England and Wales during 1931, 1932 and 1933.

Records were obtained of yield of grain, yield and strength of straw, value of grain, and, at some centres, of other features of the crop, together with particulars of the soil and situation of the individual trial centres.

The number of centres arranged in 1931 was satisfactory, but the reduction due to the effects of the economic crisis brought the numbers in 1932 and 1933 to a point at which statistically significant results were unlikely of attainment.

As far as total yield of grain was concerned, it appeared that under all circumstances Golden Rain II produced a heavier crop than either Victory or Marvellous, which themselves gave similar yields.

Few records were obtained of the yields of headcorn, but it was clear that Golden Rain II tended to produce a larger proportion of " seconds " than the other varieties. It seemed likely that this factor would at least counterbalance its higher total yield, so that there would seem to be little to choose between the varieties in yield of saleable grain.

Golden Rain II and Victory produced similar yields of straw, both outyielding Marvellous.

In 1931 there was some indication that Golden Rain II resisted lodging rather better than the other varieties, and that of the latter Marvellous was superior to Victory. The amount of lodging in the succeeding years was, however, too small to provide confirmation of this tendency.

Throughout the period samples of Victory fetched higher prices than those of Golden Rain II and the latter was valued rather higher than Marvellous. This order was, with few exceptions, the same in all districts.

Of the supplementary varieties grown in the trials, none produced significantly higher average total yields than the mean yield of the principal varieties at the centres concerned.

CONCLUSIONS.

The general view is that of the three varieties Victory is the most profitable when grown for sale and Golden Rain II when grown for feeding on the farm. This view is confirmed by the results of the trials.

Golden Rain II was superior in total yield to Marvellous and Victory; it gave as high a yield of straw as Victory, and was superior in this respect to Marvellous, and it showed signs of being less liable to lodge than either of the other varieties. On the other hand, the headcorn was valued at a lower figure than Victory, so that in view of the larger proportion of " seconds " which it produces, it is probably no more profitable when grown for sale than the latter variety.

There was generally very little difference between Marvellous and Victory, but the latter appeared to be preferred.

The relations which the varieties bear one to another are very much the same under a wide range of situations and soils and it is clear that of the varieties tested, none is more suited to a particular district or set of conditions than another. This is indeed the most striking fact which emerges from the three years' work.

COUNTY SPRING OAT TRIALS, 1934.

B. BRANDRETH, B.A.

In conjunction with county agricultural education authorities and other bodies a rather larger number of these trials was arranged than in 1933. Seed was supplied to fifty-five centres, from forty-nine of which returns had been received by the end of August, 1935. It was not possible to delay the publication of the results, and account could not therefore be taken of the six trials from which results had not been returned.

Records relating to the four chief varieties were obtained from thirty-eight centres; as to the remainder, the crops at five centres were failures, one set of returns was stolen, and in five cases no records of yield could be obtained. Thus, although rather more trials were drilled than in 1933, the number of useful returns was lower than in any previous year.

The following is a list of the counties from which records of the four chief varieties were obtained :—

Berkshire, Pembrokeshire, Northumberland	Four centres each.
Bedfordshire	Three centres.
Cumberland and Westmorland, Gloucestershire, Lincolnshire (Lindsey), Lincolnshire (Kesteven), Brecon and Radnor, Flintshire	Two centres each.
Durham, Devonshire, Hertfordshire, Isle of Wight, Leicestershire, Staffordshire, Warwickshire, Yorkshire, Carnarvonshire, Glamorgan, Monmouthshire	One centre each.

The chief varieties grown in the trials were Eagle, Golden Rain II and Star, productions of the Svalöf Plant Breeding Station, and Progress, bred by Messrs. Gartons, of Warrington. As in other years, seed was grown by the N.I.A.B. and distributed at the cost of production to those carrying out the trials.

In thirty-four cases the returns were from single plots, the remaining four trials consisting of duplicate plots.

Yield of grain.

The average total yields of grain in England and Wales respectively, and in the four sections into which the English counties were divided, are given in Table I.

Table I.

Section	No. of trials	Average yield of grain (cwt. per acre)					
		Eagle	Golden Rain II	Progress	Star	S.E. of mean	Significant difference
England. All sections ...	27	24·64	22·62	21·08	23·11	0·44	1·27
Wales	11	24·36	22·38	21·73	23·10	0·64	2·00
England. North	8	28·21	25·11	23·72	24·50	0·78	2·53
Midland ...	5	21·35	20·85	19·66	21·21	—	—
East	8	24·89	21·85	20·53	24·15	0·80	2·61
South	6	22·30	21·81	19·47	21·45	—	—

In every section of the country, Eagle produced the heaviest average yield of grain, and Progress the lowest, Golden Rain II and Star occupying intermediate positions. The number of trials in the Midland and Southern areas was too small to allow statistically significant differences to be shown, but elsewhere the consistency and degree of reliability of the results is high.

The significant differences are as follows :—

England (All districts).

Eagle	outyielded	Progress	by 17 per cent.
Eagle	,,	Golden Rain II	,, 9 ,, ,,
Eagle	,,	Star	,, 7 ,, ,,
Star	,,	Progress	,, 10 ,, ,,
Golden Rain II	,,	Progress	,, 7 ,, ,,

Wales.

Eagle	outyielded	Progress	by 12 per cent.

The superiority of Eagle over Golden Rain II just escaped significance.

England (North).

Eagle	outyielded	Progress	by 19 per cent.
Eagle	,,	Star	,, 15 ,, ,,
Eagle	,,	Golden Rain II	,, 12 ,, ,,

England (East).

Eagle	outyielded	Progress	by 21 per cent.
Eagle	,,	Golden Rain II	,, 14 ,, ,,
Star	,,	Progress	,, 18 ,, ,,

Three or more trials were grown in four counties, and the average county yields in these cases are given below :—

Bedfordshire	(3 centres)	Eagle	22·99 cwt. per acre.
		Golden Rain II	20.02 ,, ,, ,,
		Progress	20·02 ,, ,, ,,
		Star	21·66 ,, ,, ,,
Berkshire	(4 centres)	Eagle	20·06 ,, ,, ,,
		Golden Rain II	21·25 ,, ,, ,,
		Progress	17·10 ,, ,, ,,
		Star	20·74 ,, ,, ,,

Pembrokeshire	(4 centres)	Eagle	17·94 ,, ,, ,,
		Golden Rain II	17·01 ,, ,, ,,
		Progress	17·93 ,, ,, ,,
		Star	17·25 ,, ,, ,,
Northumberland	(4 centres)	Eagle	25·58 ,, ,, ,,
		Golden Rain II	25·65 ,, ,, ,,
		Progress	22·70 ,, ,, ,,
		Star	23·30 ,, ,, ,,
		Pure Line Potato	24·98 ,, ,, ,,
		Victory	22·68 ,, ,, ,,

Pure Line Potato and Victory were grown at every centre in Northumberland, but yields of Victory were obtainable from three trials only, since in the remaining trial the crop was so badly lodged as to be inseparable.

A number of additional varieties were grown at certain centres. The average yields of grain, together with the average yields of the four principal varieties at the centres in question, are included in Table II.

Table II.

Variety	No. of returns	Yield of grain (cwt. per acre)	Mean yield of four principal varieties (cwt. per acre)
Ascot	1	15·79	17·84
Elder	2	24·27	a
Marvellous	2	26·51	24·30
Onward	1	26·36	21·43
Pure Line Potato	5	23·97	23·73
Record	2	20·67	a
Resistance	2	16·33	19·67
Superb	3	19·43	a
Supreme	2	18·72	a
Victory	6	25·88	23·98
Yielder	2	21·59	24·08

(a) All of the four principal varieties were not grown at these centres.

Straw.

Nineteen centres recorded the yield of straw from each variety, and the averages of these are given in Table III. It will be seen that the differences in this respect were small.

Table III.

Average yield of straw (19 centres).

Eagle	24·67 cwt. per acre
Golden Rain II ...	24·73 ,, ,, ,,
Progress	23·94 ,, ,, ,,
Star	24·54 ,, ,, ,,

At the few centres where the crops were laid, Eagle stood decidedly better than any of the other varieties. At the same time, since lodging occurred in only six trials, no final conclusions on this point can be drawn.

Value of Grain.

Samples of the grain were valued locally at twenty-eight of the centres. In a few cases there were small differences in the prices quoted for the different varieties, but in the majority of cases the valuations were practically identical.

The average value of the grain in both England and Wales was 6/8 per cwt. for Golden Rain II and Progress, and 6/9 per cwt. for Eagle and Star.

Summary.

From the results of the first year's county trials of the varieties Golden Rain II, Eagle, Progress and Star, it would appear that Eagle is the heaviest yielding variety, followed by Star. The grain of Eagle is smaller than that of Star, and the latter may be a better proposition when grown for sale.

There are indications that Eagle stands better than the other varieties.

It was noted at almost every centre that Eagle was later in ripening than Golden Rain II or Star. The difference was small, but on the average amounted to between one and two days. In a wet season and in late districts Star might therefore be preferable to Eagle.

TRIALS OF WINTER OATS, 1931-32 TO 1933-34.

E. G. THOMPSON, M.A.

Trials were commenced in the autumn of 1931 of a number of new winter oats. The varieties which were tested for one or more seasons during the three year period were as follows :—

Three oats numbered 109/3, 125/3 and 136/17 bred by Dr. Hunter at the Cambridge Plant Breeding Institute, the parents being Grey Winter and an Argentine spring oat. The oat Ex 109/1 culture 7 was a derivative of the same cross.

Three oats numbered S.81, S.82 and 1/2/3/54 bred by Mr. E. T. Jones at the Welsh Plant Breeding Station, the parents being Grey Winter and Kyko, a Cyprus oat.

Unique, introduced by Messrs. Gartons Ltd., the origin of the variety being Grey Winter.

In addition, during the first season, trials of a French stock of Grey Winter were carried out in order to complete a series of trials which had been started in 1929-30.

All the new oats had creamy white grain. The trials were conducted on the normal Beaven's half-drill strip system used by the Institute, and if it had been possible Grey Winter would have been used as the control throughout the series. The serious weakness of the straw of Grey Winter made it quite unsuitable for this purpose however, and it was decided to use one of the Welsh oats, S.81, as control and to include Grey Winter as a variety among the rest.

The trials were carried out at the Institute's six stations, and in addition, through the kindness of Northumberland County Council, trials of the two varieties 136/17 and S.81 were carried out at the County Demonstration Farm, Cockle Park, Morpeth, Northumberland.

The particulars of the soils, manuring and previous cropping at these stations are given in Table I.

1931-32 trials.

All the trials were sown under reasonably good conditions between the 22nd October and the 16th November and the early growth was satisfactory. The winter was dry and not very severe, and no varieties were seriously injured although differences in hardiness were noticeable. All the seed had been dusted with a mercurial disinfectant and the trials remained comparatively free from disease. The weather during the spring and summer of 1932 was fairly normal and some heavy rain storms occurred, providing a useful test of straw strength. Very severe lodging occurred at Good Easter and considerable lodging at Newport, while at all centres Grey Winter and Unique were badly laid. At Newport bird attack followed on the lodging and intensified the damage already done.

1932-33 trials.

The variety 1/2/3/54 was added to the trials in this season and an alteration was made in the trials of Unique. It was suggested that the extensive lodging of Unique was caused by too heavy seeding. Three trials were arranged therefore, in which Unique was sown at 2 bushels per acre, and 136/17 (sown at 3½ bushels per acre) used as control, in place of S.81, which had also shown some straw weakness.

Sowing conditions were wet but fairly satisfactory, and all the drilling was completed between the 17th October and the 9th November. The weather after brairding was very favourable to growth, and the trials made good progress during the early winter. As in the previous season, no very severe frosts occurred, and although differences in winter hardiness were noticeable, no serious harm was done to any variety except at Cockle Park, Northumberland, where the variety 136/17 suffered more damage than the control, S.81. Progress during the spring was satisfactory at all centres except Good Easter, where eelworm attack developed and caused serious injury to several varieties. The low yields of 109/3, 125/3 and S.82 at this station were mainly due to eelworm damage.

The weather during the late spring and early summer was not very favourable to growth. A very dry period occurred during the second half of May and early June, and another hot dry spell occurred in July and August. As a result, ripening tended to be premature, and there was little test of straw strength at most stations. The only variety to show extensive lodging was Grey Winter. Unique at the low seed rate stood better than Grey Winter at the normal rate, but none the less showed some lodging even under these favourable conditions.

1933-34 trials.

Many alterations were made in the programme of trials for 1933-34. Grey Winter, Unique, 109/3 and 125/3 were discontinued, while the variety Ex 109/1 cult 7, which had been tried at Cambridge only in 1932-33, was included at all stations. A series of observation plots were sown adjoining the trials to provide a scale for comparison of winter hardiness. Four varieties were included in these plots, Grey Winter, Bountiful, Marvellous and Abundance.

Favourable weather in September and October enabled early drilling to take place, and all the trials were sown in October. Good progress was made during the autumn and early winter, and once again no very severe test of winter hardiness took place. Eelworm attack occurred again at Good Easter and a severe attack occurred at Cannington. Two trials failed completely at Good Easter, while at Cannington all the trials failed except the 136/17 trial, which was on an area less severely affected.

The weather during the growing period of 1934 was again rather unfavourable. Drought occurred during June and July, and ripening was premature. There was no test of straw strength, and no serious lodging occurred. The variety Ex 109/1 cult 7 was early and suffered considerably from birds at Newport and to some extent at Sprowston.

FIELD CHARACTERISTICS OF THE VARIETIES.

Tillering and early growth.

In so far as it is possible to judge these characters in drilled crops, three of the varieties, 125/3, 136/17 and Ex 109/1 cult 7 were intermediate between the erect, low tillering " spring type " of oat and the prostrate, free tillering " winter type " of oat. The others were all more or less prostrate and free tillering. It was quite evident from the trials, however, that the habit of the plant when young was not a reliable test of winter hardiness.

Winter hardiness.

Although no long periods of severe frost occurred during the three years, considerable differences were noted in the behaviour of the varieties during the winters, particularly in the reaction to the spells of moderate frosts and cold winds during February and March. Further, through the kindly co-operation of the institutions concerned, tests were carried out in 1932-33 by the North of Scotland College of Agriculture, the Institute for Plant Breeding, Wageningen, Holland, the Svalöf Plant Breeding Institute, Sweden, and the Institute of Agricultural Botany, Braunschweig, Germany. At Svalöf and at Braunschweig artificial freezing tests were conducted in addition to those under natural conditions, and these tests were repeated in 1933-34. While there was by no means complete agreement in all these tests, yet the general order agreed fairly closely with the order shown in the field trials.

The order of hardiness shown in the field trials was as follows :—

Grey Winter Unique Ex 109/1 cult 7	the most hardy.
S.81 109/3	
S.82 1/2/3/54	
125/3 136/17	
Bountiful	
Marvellous	
Abundance	

The only material alteration to this order shown by the artificial freezing tests was to reverse the positions of S.81 and S.82, and to place 125/3 above 1/2/3/54. It is very doubtful whether, in this country, winter hardiness consists solely in the power to resist freezing.

Time of maturity.

The differences in the date of maturity shown by the varieties were large, there being on the average a difference of twelve days between the earliest and the latest, and this in spite of the fact that in two of the seasons ripening was very rapid.

The average order of maturity in comparison with Grey Winter was as follows :—

Unique	5 days less.
Ex 109/1 cult 7	4 days less.
109/3	3 days less.
Grey Winter	equal.
S.81	equal.
1/2/3/54	equal.
136/17	1 day more.
S.82	3 days more.
125/3	6 days more.

Straw.

The length of straw varied greatly, most of the varieties being definitely shorter than Grey Winter. The average of the lengths recorded compared with Grey Winter were :—

Grey Winter and 125/3	equal.
109/3 and Ex 109/1 cult 7	1 inch less.
Unique	2 inches less.
1/2/3/54	3 inches less.
S.81	5 inches less.
S.82	6 inches less.
136/17	9 inches less.

The thickness of the straw did not show such great variation. The only variety which had stout straw was 125/3.

The difference in the standing power of the straw was one of the striking features of the trials. Grey Winter and Unique had weak straw which "lodged" extensively. Lodging in the other varieties was less frequent, and although the comparative degree of lodging in the varieties depended partly on the stage of maturity reached when the test came, the average order of resistance to lodging was as follows :—

136/17	the most resistant.
S.82	
Ex 109/1 cult 7	
1/2/3/54	
S.81	
125/3	
109/3	
Unique	the least resistant.
Grey Winter	the least resistant.

Resistance to eelworm.

Eelworm attack occurred at Good Easter in two seasons and at Cannington in one season. No evidence could be found that infection was seed borne, and the intensity of the attack varied very considerably between variety and variety. While the evidence was too slender to permit dogmatic statements to be made, the varieties 109/3, 125/3 and S.82 appeared to be more susceptible to the attack than the other varieties.

GRAIN.

Market valuation.

Samples of grain from the trials were valued through the kindness of Mr. C. J. Mapey. The figures set out in Table VII show that the differences in price were quite small, the extremes being only elevenpence apart, or just over 5 per cent. of the price of the control variety. Compared with the figures for husk given in Table VIII they show once again that the market value and the feeding value are quite distinct. The highest market value, compared with the control, was given to 125/3, which was a large, fairly plump grain, with however a moderately high husk. The lowest market value was given to 109/3, which had the lowest proportion of husk. It was however a long thin grain with a fairly strong awn. There is no doubt that oat millers, in particular, like a short plump grain even though it may have a thick husk.

Feeding Value.

The figures for the percentage of husk in the total grain, given in Table VIII, show that only one variety, 109/3, had as low a husk as Grey Winter. The difference between the highest and the lowest was between 6 and 7 per cent. Thus, based on these figures, none of the varieties was of better feeding value than Grey Winter, and only one of equal value.

CONSIDERATION OF THE VARIETIES.

109/3.

This variety was early, fairly hardy and had grain with a low husk. On the other hand, although the straw stood better than Grey Winter, it was not strong. Further, the grain although thin in the husk was of the type definitely disliked for market purposes.

125/3.

Under favourable conditions this oat was capable of very high yields of marketable grain. Its disadvantages were that it was very late maturing and its long straw, although stout, was not very strong. In addition, it was not very winter hardy and was on one occasion badly damaged by eelworm.

S.81.

The chief merit of this oat was its "all-round" capabilities. It was fairly hardy, gave moderately high yields of marketable grain, was about average in its time of maturity, and except on one or two occasions, stood moderately well at harvest.

S.82.

S.82 was fairly hardy, yielded very well and stood well. Its grain was inclined to be small but was valued exactly the same as S.81. It was rather later than most of the oats, but was not too late. It showed indications of being highly susceptible to eelworm.

1/2/3/54.

In most important features this oat occupied a place between S.81 and S.82. In yield and standing power it was better than S.81 but below S.82. In hardiness it was similar to S.82, in maturity similar to S.81.

Ex 109/1 cult 7.

This oat, only tried at all stations in the third year, was promising. It was hardy and yielded well except where damaged by birds. It stood well and gave " attractive " grain with a fairly thin husk.

136/17.

The chief merits of this oat were a very short straw, which stood better than any other in the trials, and a very high yield of grain. Its chief faults were its comparative lack of hardiness and the size of its grain. It has been marketed under the name Resistance, as being suitable for rich soils, sown either in the autumn where severe frosts are not expected, or in the early spring.

Unique.

Very hardy like Grey Winter, this oat had most of the merits and demerits of Grey Winter. It was exceptionally early, but usually gave only moderate yields and was easily lodged. Its grain had more husk than Grey Winter.

Grey Winter.

The characters of this variety are fairly well known. Hardy with high quality grain and long straw. Its yield was only moderate and it lodged very easily.

The trials of a French strain of this very old variety, completed in 1931-32, showed that slight differences do exist between different strains, but in view of the very weak straw of both strains this variety was only suited to poor land and even on poor land an oat with stronger straw would be an advantage.

Table I.

WINTER OAT TRIALS, 1931-32 to 1933-34.

Summary of Soils, Manuring and Previous Cropping.
Weights all per acre.

Season	Cambridge	Good Easter	Cannington	Long Sutton	Newport	Sprowston	Cockle Park.
1931-32	Heavy loam. 80 ft. above sea. 1 cwt. Nitro-Chalk. Wheat.	Heavy calcareous clay. 190 ft. above sea. ¾ cwt. Nitrate of Soda. Trefoil.	Silty loam. 35-60 ft. above sea. No manure. Seeds hay.	Medium heavy loam. 420 ft. above sea. No manure. Clover.	Sandy loam. 200 ft. above sea. 1 cwt. Nitrate of Soda. Potatoes.	Light loam. 100 ft. above sea. 3 cwt. Super. 2 cwt. 30% Potash Salts. 1 cwt. Sulphate of Ammonia. Wheat.	
1932-33	Light gravelly loam. 90 ft. above sea. 2 cwt. Super. ½ cwt. 30%. Potash Salts. 1¼ cwt. Nitro-Chalk. Wheat.	Heavy calcareous clay. 190 ft. above sea. 2 cwt. Super. Clover.	Silty loam. 40 ft. above sea. No manure. Ley.	Stony loam. 480 ft. above sea. No manure. Wheat.	Sand. 230 ft. above sea. No manure. Potatoes.	Light stony loam. 90 ft. above sea. No manure. Ley.	Clay loam. 340 ft. above sea. 2 cwt. Nitro-Chalk. Ley (2 years).
1933-34	Medium loam. 80 ft. above sea. No manures. Fallow.	Heavy calcareous clay. 185 ft. above sea. 2 cwt. Super. 1 cwt. Sulphate of Ammonia. Beans.	Silty loam. 20-30 ft. above sea. 1½ cwt. Sulphate of Ammonia. Spring oats.	Heavy loam. 420 ft. above sea. 1 cwt. Sulphate of Ammonia. Wheat.	Sandy loam. 100 ft. above sea. 2½ cwt. Super. 1 cwt. Sulphate of Ammonia. Wheat.	Free working loam. 100 ft. above sea. No manure. Ley.	Clay loam. 350 ft. above sea. 12 tons farmyard manure. 1 cwt. Nitro-Chalk. 1½ cwt. Nitrate of Soda. Winter oats.

Table II.

YIELD OF WINTER OATS, 1931-32.

Differences exceeding twice the standard error are regarded as significant and are printed in heavier type.

Station and yield per acre of control variety, threshed weight	Name of variety	Yield of grain as percentage of control, dry weight	Difference from control	Standard error of difference	Yield of straw as percentage of control, threshed weight
CAMBRIDGE.	109/3	101	+ 1	1·14	98
S.81	125/3	120	**+20**	2·05	149
Average yield per acre,	136/17	119	**+19**	1·56	102
32·1 cwt.	S.82	110	**+10**	1·29	108
	Unique	86	**−14**	1·97	107
	Grey Winter	86	**−14**	2·12	109
GOOD EASTER.	109/3	118	**+18**	2·30	99
S.81	125/3	127	**+27**	4·91	107
Average yield per acre,	136/17	133	**+33**	2·29	96
22·0 cwt.	S.82	117	**+17**	3·44	104
	Unique	143	**+43**	3·70	119
	Grey Winter	109	**+ 9**	2·60	102
English Grey Winter 25·4 cwt.	French Grey Winter	103	+ 3	5·29	102
CANNINGTON.	109/3	113	**+13**	1·37	101
S.81	125/3	114	**+14**	1·86	119
Average yield per acre,	136/17	126	**+26**	1·56	86
31·1 cwt.	S.82	108	**+ 8**	2·02	100
	Unique	86	**−14**	2·12	105
	Grey Winter	92	**− 8**	1·86	94
English Grey Winter 24·4 cwt.	French Grey Winter	105	**+ 5**	1·62	116
LONG SUTTON.	109/3	82	**−18**	3·47	89
S.81	125/3	92	**− 8**	3·65	115
Average yield per acre,	136/17	124	**+24**	1·78	94
25·7 cwt.	S.82	104	**+ 4**	1·83	109
	Unique	96	− 4	2·26	123
	Grey Winter	91	**− 9**	2·44	91
NEWPORT.	109/3	81	**−19**	2·18	98
S.81	125/3	134	**+34**	1·38	136
Average yield per acre,	136/17	124	**+24**	2·39	94
27·9 cwt.	S.82	127	**+27**	1·62	108
	Unique	67	**−33**	3·18	120
	Grey Winter	72	**−28**	2·26	106
SPROWSTON.	109/3	96	− 4	3·58	92
S.81	125/3	104	+ 4	2·70	127
Average yield per acre,	136/17	115	**+15**	1·66	86
30·1 cwt.	S.82	117	**+17**	2·08	95
	Unique	79	**−21**	3·00	112
	Grey Winter	88	**−12**	5·33	112

Table III.

YIELD OF WINTER OATS, 1932-33.

Differences exceeding twice the standard error are regarded as significant and are printed in heavier type.

Station and yield per acre of control variety, threshed weight	Name of variety	Yield of grain as percentage of control, dry weight	Difference from control	Standard error of difference	Yield of straw as percentage of control, threshed weight
CAMBRIDGE.	109/3	108	**+ 8**	1·41	97
S.81	125/3	112	**+12**	1·92	133
Average yield per acre,	136/17	118	**+18**	1·02	85
25·5 cwt.	S.82	112	**+12**	1·11	102
	Grey Winter	102	**+ 2**	0·97	110
	1/2/3/54	99	− 1	1·68	100
	Ex 109/1/7	100	—	1·17	100
GOOD EASTER.	109/3	87	**−13**	2·02	68
S.81	125/3	62	**−38**	4·10	76
Average yield per acre,	136/17	115	**+15**	1·29	75
33·9 cwt.	S.82	70	**−30**	1·81	69
	Grey Winter	82	**−18**	3·95	106
	1/2/3/54	97	− 3	2·26	117
136/17, 37·9 cwt.	Unique (low seeding)	85	**−15**	2·26	139
CANNINGTON.	109/3	70	**−30**	2·03	89
S.81	125/3	102	+ 2	1·72	112
Average yield per acre,	136/17	103	**+ 3**	1·26	82
18·8 cwt.	S.82	101	+ 1	0·89	117
	Grey Winter	79	**−21**	1·97	112
	1/2/3/54	99	− 1	1·31	96
136/17, 14·7 cwt.	Unique (low seeding)	78	**−22**	1·68	112
LONG SUTTON.	109/3	87	**−13**	1·95	106
S.81	125/3	92	**− 8**	3·04	109
Average yield per acre,	136/17	101	+ 1	1·08	83
17·0 cwt.	S.82	108	**+ 8**	1·26	112
	Grey Winter	104	**+ 4**	1·69	137
	1/2/3/54	107	**+ 7**	2·20	136
NEWPORT.	109/3	102	+ 2	2·94	98
S.81	125/3	109	**+ 9**	2·85	154
Average yield per acre,	136/17	104	+ 4	2·32	77
24·7 cwt.	S.82	117	**+17**	2·94	100
	Grey Winter	85	**−15**	2·78	109
	1/2/3/54	113	**+13**	4·14	103
SPROWSTON.	109/3	83	**−17**	2·36	106
S.81	125/3	102	+ 2	1·43	157
Average yield per acre,	136/17	102	**+ 2**	1·59	108
35·1 cwt.	S.82	103	+ 3	2·26	103
	Grey Winter	68	**−32**	1·71	97
	1/2/3/54	98	− 2	1·53	104
136/17, 33·8 cwt.	Unique (low seeding)	90	**−10**	1·04	108
COCKLE PARK. S.81 Average yield per acre, 40·3 cwt.	136/17	87	**−13**	2·69	67

Table IV.

YIELD OF WINTER OATS, 1933-34.

Differences exceeding twice the standard error are regarded as significant and are printed in heavier type.

Station and yield per acre of control variety, threshed weight	Name of variety	Yield of grain as percentage of control, dry weight	Difference from control	Standard error of difference	Yield of straw as percentage of control, threshed weight
CAMBRIDGE. S.81 Average yield per acre, 23·9 cwt.	136/17	116	+ **16**	1·80	80
	S.82	98	− **2**	0·94	99
	1/2/3/54	103	+ 3	2·13	94
	Ex 109/1/7	124	+ **24**	3·42	106
GOOD EASTER. S.81 Average yield per acre, 33·5 cwt.	1/2/3/54	99	− 1	2·52	107
	Ex 109/1/7	108	+ **8**	2·25	98
CANNINGTON. S.81 Average yield per acre, 21·7 cwt.	136/17	109	+ **9**	1·25	74
LONG SUTTON. S.81 Average yield per acre, 25·1 cwt.	136/17	96	− 4	2·37	86
	S.82	99	− 1	1·76	97
	1/2/3/54	103	+ 3	1·86	102
	Ex 109/1/7	109	+ **9**	0·96	107
NEWPORT. S.81 Average yield per acre, 31·0 cwt.	136/17	107	+ **7**	1·66	92
	S.82	107	+ **7**	2·73	109
	1/2/3/54	95	− **5**	0·96	93
	Ex 109/1/7	77	− **23**	1·62	99
SPROWSTON. S.81 Average yield per acre, 23·6 cwt.	136/17	93	− **7**	2·94	85
	S.82	104	+ 4	3·57	100
	1/2/3/54	102	+ 2	2·06	100
	Ex 109/1/7	86	− **14**	1·46	121
COCKLE PARK. S.81 Average yield per acre, 32·6 cwt.	136/17	99	− 1	3·19	85

Table V.

AVERAGE YIELDS OF WINTER OATS, 1931-32 to 1933-34.

Grain (dry weight).

The figures in brackets indicate the number of trial results included in the average.

	Cambridge	Good Easter	Cannington	Long Sutton	Newport	Sprowston	Cockle Park	General average
S.81 ...	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0
109/3 ...	104·5 (2)	102·5 (2)	91·5 (2)	84·5 (2)	91·5 (2)	89·5 (2)	—	94·0 (12)
125/3 ...	116·0 (2)	94·5 (2)	108·0 (2)	92·0 (2)	121·5 (2)	103·0 (2)	—	105·8 (12)
136/17 ...	117·7 (3)	124·0 (2)	112·7 (3)	107·0 (3)	111·7 (3)	103·3 (3)	93·0 (2)	110·1 (19)
S.82 ...	106·7 (3)	93·5 (2)	104·5 (2)	103·7 (3)	117·0 (3)	108·0 (3)	—	106·3 (16)
Grey Winter	94·0 (2)	95·5 (2)	85·5 (2)	97·5 (2)	78·5 (2)	78·0 (2)	—	88·2 (12)
Unique ...	86·0 (1)	143·0 (1)	86·0 (1)	96·0 (1)	67·0 (1)	79·0 (1)	—	92·8 (6)
1/2/3/54 ...	101·0 (2)	98·0 (2)	99·0 (1)	105·0 (2)	104·0 (2)	100·0 (2)	—	101·4 (11)
Ex 109/1/7	112·0 (2)	108·0 (1)	—	109·0 (1)	77·0 (1)	86·0 (1)	—	100·7 (6)

Table VI.

AVERAGE YIELD OF WINTER OATS, 1931-32 TO 1933-34.

Straw (threshed weight).

The figures in brackets indicate the number of trial results included in the average.

	Cambridge	Good Easter	Cannington	Long Sutton	Newport	Sprowston	Cockle Park	General average
S.81 ...	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0
109/3 ...	97·5 (2)	83·5 (2)	95·0 (2)	97·5 (2)	98·0 (2)	99·0 (2)	—	95·1 (12)
125/3 ...	141·0 (2)	91·5 (2)	115·5 (2)	112·0 (2)	145·0 (2)	142·0 (2)	—	124·5 (12)
136/17 ...	89·0 (3)	85·5 (2)	80·7 (3)	87·7 (3)	87·7 (3)	93·0 (3)	76·0 (2)	86·2 (19)
S.82 ...	103·0 (3)	86·5 (2)	108·5 (2)	106·0 (3)	105·7 (3)	99·3 (3)	—	102·0 (16)
Grey Winter	109·5 (2)	104·0 (2)	103·0 (2)	114·0 (2)	107·5 (2)	104·5 (2)	—	107·1 (12)
Unique ...	107·0 (1)	119·0 (1)	105·0 (1)	123·0 (1)	120·0 (1)	112·0 (1)	—	114·3 (6)
1/2/3/54 ...	97·0 (2)	112·0 (2)	96·0 (1)	119·0 (2)	98·0 (2)	102·0 (2)	—	104·7 (11)
Ex 109/1/7	103·0 (2)	98·0 (1)	—	107·0 (1)	99·0 (1)	121·0 (1)	—	105·2 (6)

Table VII

VALUATION OF THE GRAIN IN SHILLINGS PER 336 LB.

	109/3	S.81 Control to 109/3	125/3	S.81 Control to 125/3	136/17	S.81 Control to 136/17	S.82	S.81 Control to S.82	Grey Winter	S.81 Control to Grey Winter	Unique	S.81 Control to Unique	1/2/3/54	S.81 Control to 1/2/3/54	Ex 109/1/7	S.81 Control to Ex 109/1/7
1931-32.																
Cambridge	19·0	19·0	20·0	19·0	19·5	20·0	19·0	19·0	19·0	20·0	20·0	20·0				
Good Easter ..	17·0	19·0	20·0	18·0	18·0	19·5	19·0	18·0	18·0	18·0	19·0	19·0				
Cannington ..	19·0	20·0	20·0	19·0	20·0	19·5	20·0	19·5	18·0	19·0	20·0	20·0				
Long Sutton .	17·0	17·0	18·0	17·5	18·5	17·5	18·0	18·0	17·0	17·0	18·0	17·5				
Newport .	18·0	18·5	18·0	18·0	19·0	18·0	19·0	18·0	18·5	18·0	19·0	19·0				
Sprowston ..	17·0	17·0	19·0	18·0	18·5	18·0	18·5	19·0	18·0	18·0	17·5	18·0				
1932-33.																
Cambridge ..	18·0	18·5	19·0	18·5	19·5	18·5	18·0	19·0	19·0	18·5			18·5	18·5	19·0	18·5
Good Easter ...	18·0	18·0	18·0	18·5	18·5	18·0	18·0	18·5	18·0	19·0			18·0	18·5		
Cannington .	17·5	19·0	18·0	18·0	18·5	18·5	18·5	18·5	18·0	18·5			18·0	18·5		
Long Sutton ...	18·0	18·5	18·5	18·0	18·5	18·5	18·0	18·0	19·0	18·0			18·5	18·0		
Newport ..	18·0	18·5	19·0	18·5	18·5	19·0	19·0	18·5	18·5	18·5			18·5	18·0		
Sprowston ..	18·0	18·0	18·5	18·5	18·0	18·5	18·0	18·5	18·0	18·5			19·0	18·0		
Cockle Park ...					18·5	19·0										
1933-34.																
Cambridge ...					20·0	21·5	21·0	21·0					20·5	21·0	21·0	21·5
Good Easter ..													21·5	21·5	21·5	21·5
Cannington ..					22·0	22·0										
Long Sutton .					21·0	21·0	20·5	21·0					21·5	21·0	21·5	21·0
Newport .					21·0	21·5	22·0	21·0					22·0	21·0	21·5	21·5
Sprowston					20·5	21·5	20·5	21·5					21·5	21·0	22·0	21·0
Cockle Park					21·5	21·5										
Average in shillings	17·9	18·4	18·8	18·3	19·4	19·6	19·2	19·2	18·3	18·4	18·9	18·9	19·8	19·5	21·1	20·8
As percentage of control ..	97·3		102·7		99·0		100·0		99·5		100·0		101·6		101·5	

Table VIII.

HUSK AS A PERCENTAGE OF THE TOTAL GRAIN WEIGHT.

Each figure is the average percentage of husk of five samples each of 100 grains.

	109/3	S.81 Control to 109/3	125/3	S.81 Control to 125/3	136/17	S.81 Control to 136/17	S.82	S.81 Control to S.82	Grey Winter	S.81 Control to Grey Winter	Unique	S.81 Control to Unique	1/2/3/54	S.81 Control to 1/2/3/54	Ex 109/1/7	S.81 Control to Ex 109/1/7
1931-32.																
Cambridge ...	22·7	27·3	27·0	27·1	28·5	26·9	27·4	27·2	22·1	27·0	25·8	26·9				
Good Easter ...	24·0	26·5	26·7	27·2	30·1	26·0	28·5	27·6	23·0	26·9	26·6	26·3				
Cannington .	21·7	26·3	27·1	26·9	26·6	25·9	26·5	26·3	21·9	26·1	23·9	26·2				
Long Sutton ..	24·6	31·9	34·2	28·0	29·7	29·2	29·6	29·0	25·9	27·9	27·4	27·4				
Newport ..	21·7	24·7	26·6	26·0	26·0	26·2	26·3	27·7	22·3	27·9	24·9	25·0				
Sprowston ...	21·9	25·8	25·9	25·4	28·3	26·3	26·8	25·7	21·1	26·1	24·5	25·7				
1932-33.																
Cambridge ...	22·9	28·9	27·0	27·6	30·6	28·8	30·2	28·4	22·0	28·4			29·6	27·8	23·7	29·0
Good Easter ...	22·2	27·7	31·3	27·2	29·2	27·1	28·5	27·3	22·1	25·2			29·0	26·6		
Cannington	24·0	29·7	29·9	29·7	30·9	29·9	31·5	29·2	23·7	30·0			30·8	30·2		
Long Sutton .	22·0	26·3	26·2	25·4	27·6	26·5	26·5	26·9	22·3	26·7			26·9	28·0		
Newport	21·5	26·5	26·2	26·6	29·6	26·2	27·1	26·8	21·7	26·9			28·0	26·9		
Sprowston ...	22·6	26·6	29·6	26·7	29·2	27·2	27·8	26·7	22·4	26·1			26·8	26·7		
Cockle Park ...					29·3	26·9										
1933-34.																
Cambridge ...					31·2	29·7	30·0	30·6					32·1	30·6	26·6	29·0
Good Easter ...													29·3	28·9	25·3	30·0
Cannington ..					28·1	25·8										
Long Sutton .					32·3	28·4	28·9	28·6					28·9	29·4	25·8	29·0
Newport ..					30·5	27·0	28·2	27·6					28·0	27·2	24·9	27·9
Sprowston ...					29·4	28·0	28·8	28·5					29·5	28·2	25·2	28·2
Cockle Park ...					28·3	26·4										
Average ..	22·7	27·4	28·1	27·0	29·4	27·3	28·3	27·8	22·5	27·1	25·5	26·3	29·0	28·2	25·3	28·9
Equal to Kernel .	77·3	72·6	71·9	73·0	70·6	72·7	71·7	72·2	77·5	72·9	74·5	73·7	71·0	71·8	74·7	71·1
Difference from Control Control=100	+6·5		−1·5		−2·9		−0·6		+6·3		+1·1		−1·1		+5·2	

TRIALS OF FIELD PEAS, 1930-1933.

E. G. THOMPSON, M.A.

Trials were commenced in 1930 of peas which were grown on a field scale for the sake of the ripe grain. During the first two years the trials included peas used for human consumption, such as Harrison's Glory and Prussian Blue, but the main part of the work was concerned with peas of the Dun and Maple types used almost entirely as animal food.

Through the generous co-operation of the Farm Institute, Kirton, Lincolnshire, trials of the Harrison's Glory type of peas were grown at Kirton on the alluvial silt during 1930 and 1931. All the remaining trials were grown on the Headquarters Trial Ground at Cambridge.

VARIETIES IN THE TRIALS.

Two Dutch varieties of blue-green peas were tried in 1930 and 1931. These were :—

Unica, a white flowered dwarf pea with straw about 18 inches long, bearing medium to small pods containing blue-green round peas. Early.

Koopman's Glory, a white flowered pea similar in many respects to Harrison's Glory. The straw was 2 ft. 6 inches to 3 ft. long, the pods fairly large, containing blue-green dented peas. Moderately early.

The peas used for comparison with the above varieties were the well-known Prussian Blue and Harrison's Glory.

Prussian Blue, a white flowered pea with slender straw about 3 ft. 6 in. to 4 ft. long, bearing numerous small pods containing very small blue-green round peas. Moderately early.

The other varieties were all, with one exception, of the "cattle feeding" type having purple flowers. They can conveniently be divided into four groups.

1. *Short Duns* (including P.27).

Mansholt's short straw Dun. A Dutch variety with very short straw and very large dun coloured seeds. Very early.

P.6/1A. A hybrid pea from the Cambridge Plant Breeding Institute, with short straw and large dun coloured seeds. Very early.

P.27 and P.50. Two selections from the Cambridge Plant Breeding Institute. They were intermediate between the two previous varieties and the normal Duns in regard to straw length and similar to P.6/1A in time of maturity. Both had moderately large seeds. Although P.27 was a variety of Pisum sativum having white flowers and pale coloured seeds it was in most respects best considered along with P.50.

2. Normal Duns.

These included Dun 4, Dun 5, Dun 8, Dun 9, P.87/1 and P.93/4, all selections from the Cambridge Plant Breeding Institute, and a commercial stock, Dun. PN.19, used as a control.

They all agreed in having uniformly dun coloured seeds and medium length straw, while they all ripened about the end of July in normal seasons at Cambridge. All the selections except P.87/1 were a little earlier than the commercial stock.

3. Black Eyed Susan Duns.

Two selections, P.93/2 and P.93/3, from the Cambridge Plant Breeding Institute were tested against a commercial stock, PN.25. This type of pea gets its name from the fact that the dun coloured seed has a black hilum. The commercial stock had longer straw than normal Dun types and ripened later. Both the selected types approached more closely to the normal Duns in straw and maturity.

4. Maples.

Four selections from the Cambridge Plant Breeding Institute, Maple 1, Maple 8, Maple 9 and P.55/1 were included in trials with three commercial stocks, PN.23, PN.16 and PN.18. PN.16, PN.18 and Maple 8 were only in trials for one season.

The Maples all agreed in having mottled seeds, long straw and a late ripening period. Maple 1 had a black hilum and was rather dark in colour generally.

METHOD OF TRIAL.

Two methods were adopted. The first was a modification of the Beaven's half drill strip system in which each half drill width became a single strip of two rows. Control and variety were thus sown from the drill at the same time in the normal way, but were separated by a space of 1 yard instead of a discard strip. In the second method the same kind of strip was sown but several varieties were tested together in one " composite trial ". The strips were arranged in " blocks ", each block containing one strip of each variety. Within the blocks the strips were arranged in a random manner. In both methods there were ten strips of each variety in a trial and the length of the strip, originally 60·5 yards giving an area of 1/80th acre, was reduced in 1931 to 48·4 yards giving an area of 1/100th acre.

GENERAL OBSERVATIONS ON GROWTH.

1930 trials.

The Kirton trial was sown after sugar beet on the 24th March. The soil was silt about 10 ft. above sea level, and beyond the sugar beet tops, which were ploughed in, the peas received no manure. The growth was satisfactory, although both varieties were attacked by thrips.

The Cambridge trial was sown on heavy clay soil after a wheat crop, and received a dressing of 4 cwt. Superphosphate and ½ cwt. 30% Potash Salts per acre. Sowing was early, on the 6th March, and the varieties were about a month coming through the ground. They were attacked in the early

stage by sitones weevils, but growth during the season was generally satisfactory and although the harvest was rather wet no serious difficulties were experienced.

1931 trials.

The Kirton trials were sown on similar soil to the trial in the previous year. They received no manure, but followed cauliflower and sugar beet, two trials following cauliflower being sown on the 7th April and one following sugar beet on the 13th April. Growth was satisfactory in the first two trials but in the third trial the peas suffered from a thick growth of chickweed.

The Cambridge trials were all sown on light gravelly loam after cereals. and the land was given a dressing of farmyard manure (12 loads), 4 cwt. Superphosphate, 1¼ cwt. 30% Potash Salts and 1 cwt. Nitro-chalk per acre. It had been considered in 1930 that the dwarf Unica was at a disadvantage in rows 18 inches apart. The Unica v. Prussian Blue trial was therefore altered so that the strips of Unica consisted of three rows 1 ft. apart instead of two rows 18 inches apart.

The P.27 and P.50 trials were sown on the 23rd March, the Dun composite trial on the 25th March and the Unica and Black Eyed Susan trials on the 7th April. The early growth was satisfactory in spite of sitones weevils. and although June was rather windy, causing the taller varieties to be blown about considerably, the flowering period passed under fairly favourable conditions.

The main difficulty in 1931 was a wet harvest. July and August were continuously wet. The early varieties were nearly ripe when the wet spell commenced and where the pods touched the ground considerable rotting took place. Unica with its short straw was particularly affected, and although the peas were eventually harvested in fairly dry condition the sample obtained on threshing was poor. The wet weather not only damaged the peas directly but seriously delayed cutting, and in the composite Dun trial two varieties, Dun 4 and Dun 8, suffered a loss of approximately 5 per cent. of the peas by shelling through being over-ripe.

Although the yield of peas obtained finally was quite good in this season, the amount of labour entailed by the very wet harvest would have made the crop a commercial failure.

1932 trials.

The trials were at Cambridge only in this season and were again sown on light loam after winter cereals. The P.93/2 and P.93/3 trials were after barley and the stubble received a dressing of 12 loads of farmyard manure as well as 2 cwt. Superphosphate, 1 cwt. 30% Potash Salts and 1 cwt. Nitro-chalk per acre. The other trials were after wheat and received only a dressing of 3 cwt. Superphosphate and 2 cwt. of 30% Potash Salts. The trials were sown early, on the 3rd, 4th and 5th March, and all the seed was dusted with a mercuric disinfectant. The seed rate was approximately 3½ bushels per acre in the Duns and about 2¾ in the Maples and Black Eyed Susans. Good brairds were obtained except in two cases. P.50 gave a thin braird owing to poor germination, and P.6/1A gave a thin braird owing to the large size of its seeds. in spite of being sown at ½ bushel per acre more than its control.

April and May were wet and cool. Progress of the trials was slow but satisfactory except for the growth of weeds. The wet weather encouraged the growth of weeds and made cleaning operations difficult and often impossible. Charlock was common, and while the taller varieties could keep above it, the dwarf varieties like P.6/1A did not grow as fast as the weeds and were in danger of being smothered. The whole of the charlock was hand pulled.

June was dry but with the wet soil, flowering was normal and the pods set well and were free from serious pests. July was wet but harvesting, although frequently interrupted, was performed under fair conditions.

1933 trials.

Several alterations were made in the 1933 trials. Since the two Black Eyed Susan types, P.93/2 and P.93/3, had proved to be more like the normal Dun type in the field, they were combined into one trial with Black Eyed Susan (PN.25) and Dun (PN.19). Also since the dwarf P.6/1A with its large seeds had been shown to require a higher seed rate and closer spacing, the trials of this variety were altered. Two trials were arranged. In one Dun 9 was the control and the strips of this variety consisted of two rows 15 inches apart while the strips of P.6/1A consisted of three rows 10 inches apart. In the other trial Mansholt's short strawed Dun was the control and all the strips consisted of three rows 10 inches apart. The Mansholt's and P.6/1A were both sown at 1 bushel per acre more than the Dun 9 to allow for the size of the seed. Counts of the population made after brairding showed that while Dun 9 and Mansholt's were approximately equal, P.6/1A was definitely higher than either of them.

The two P.6/1A trials and the Black Eyed Susan composite trial were again sown on light gravelly loam after cereals, and received a complete dressing of artificials. The normal Dun composite trial and the Maple composite trial were sown on heavy clay soil after barley. They also received a complete dressing of artificials. The two P.6/1A trials were sown on the 7th March, the Black Eyed Susan trial on the 8th March, and the Normal Dun composite trial started on the 15th March, but owing to rain it was not finished until the 22nd March. The Maple trial was sown on the 23rd March.

Growth during April and May was quite satisfactory, but a serious change occurred in early June. A week of very hot sunny weather brought progress almost to a standstill, particularly on the lighter soil. Mansholt's, which had set four or five pods per plant, suffered severely, the upper flowers dropping off. P.6/1A was just coming into flower and was checked, but when rain fell on the 12th, it recovered to a considerable extent. Dun 9, the control, had not commenced flowering. A further complication followed immediately, for green aphis multiplied rapidly and caused great damage, particularly to the Dun and Maple varieties on the heavier soil. In this aphis attack the earlier varieties suffered least. Dun PN.19 suffered severely in the Dun composite trial, while the order of yield in the Black Eyed Susan trial definitely represents the order of maturity. The Maples also suffered more than the Duns.

No serious difficulties occurred at harvest, but as a result of the very hot weather and the aphis, the yields were little more than half what they had been in 1931. The varieties which suffered most were the very early Mansholt's and the late Black Eyed Susan and Maples.

GENERAL DISCUSSION.

The trials confirmed the widely held opinion that the pea crop is an erratic one, for yields that were in 1931 in the region of 50 bushels per acre were in 1933 only about 25 bushels per acre. They also suggested some of the reasons for this erratic behaviour of peas compared with the behaviour of cereals in this country.

The inflorescence of cereals is developed comparatively early in the life history of the plant and is hidden within a sheath of leaves until the last moment, when it emerges almost fully formed ready for flowering. Until ear emergence takes place it would appear that the main flowering spike is the *last* part of the plant to suffer direct injury from drought, side tillers and leaves suffering first. Severe drought during the flowering period may affect the number of seeds set, but this critical period is comparatively short, and the conditions in this country rarely severe enough to cause serious damage.

In peas the inflorescence is not centralised in the way that it is in cereals. The stem branches and lengthens, and after a time flower buds are developed in the axils of the new leaves. If conditions are favourable the stem continues to lengthen, producing new flowers as it does so. The period from the opening of the first flowers to the setting of the last is a very critical one for the pea crop, for the *first* effect of drought or unfavourable conditions is the checking of the production of new flowers; and the dropping of some of those already formed soon follows. From this damage comparatively little recovery is possible even should favourable conditions return.

Since this critical period may last 10 to 14 days or more in any one variety and the difference in time of flowering between the early Mansholt's and the Maples was four or five weeks, it follows that great differences in the yield of different varieties may be due to climatic conditions. This was certainly the case in the Mansholt's v. P.6/1A trial in 1933 and also in the composite Dun trial in the same year. In the first case a very early variety suffered from a short early drought, and in the second case a rather late variety suffered from aphis attack. The trials showed that no clear cut answer is possible to the question as to whether the early or late maturing varieties are the best, and indeed it is obvious from what has already been said that the soil, the climate and the time of incidence of insect attacks all have their bearing on this point.

Other points which were suggested by the trials were as follows :—

1. Unlike cereals, peas have little tillering power and a low population at the start results in a thin crop. This coupled with the fact that the germination of peas, particularly those of the P. sativum species, is more easily injured than that of cereals means that failures due to a poor " stand " are more common with peas than with cereals.
2. Dwarf peas were rarely suitable under ordinary field conditions in these trials. Dwarf peas were dwarf from the time they came through the ground. They had therefore no power of suppressing weeds and required very clean land. Although the straw was short it was not strong enough to stand up and the pods came into contact with the ground even more than with the longer strawed types. In a wet season the lack of straw was a serious disadvantage even after cutting, for the pods lay in heavy masses close to the ground, were easily damaged in handling, and did not dry quickly either on the ground or in the stack.

3. Very large seeds were a disadvantage, particularly in conjunction with very short straw. Apart from the fact that a heavy increase in the seed rate was required to give an adequate population, the large pods always came in contact with the ground more owing to the ill distribution of the weight on the straw.

Undoubtedly the easiest variety to secure in good condition in a wet harvest was Prussian Blue. Its medium long straw bearing numerous small pods provided a light " puffy " mass with the weight of peas fairly evenly distributed over it. It did not pack down tightly and allowed the wind to blow through it.

Varieties.

In view of what has been said the new selections can only be compared within their own groups, and only one was sufficiently outstanding to call for comment. This was Maple 1, which in both seasons, good and bad, substantially outyielded any other Maple. The grain of this variety was also quite distinctive, being a little smaller than most Maples and a good round shape which did not become wrinkled after storing. It was however rather dark in colour, and had a black hilum, two features which are disliked by those dealing in Maple peas.

CONCLUSIONS.

Peas are an uncertain crop in this country owing to their susceptibility to damage especially during the flowering period, and to the difficulties of harvest.

Dwarf peas are particularly unsuitable for a wet climate since they lack the power of suppressing weeds and are very difficult to harvest under wet conditions.

The choice of the most suitable types to grow depends upon soil and climatic conditions. Early types avoid some insect pests, but in this district (Cambridge) may be damaged by a hot dry period in May or early June.

The easiest pea to grow and to harvest was one with a moderate length of straw and small pods, e.g. Prussian Blue, and in view of the fact that this type has a possible market for human consumption at a higher price than cattle food there appears little to be said in favour of growing purely cattle feeding types such as the Duns. There is a small " fancy " market for Maple peas for pigeon feeding and also this type, with its long straw and late maturity, is used in mixtures for green forage. Apart from the satisfaction of this limited demand there is little to be said in favour of growing Maple peas. Maple 1 was most suitable for forage purposes, and also for the market if the objection to a dark colour and black hilum can be overcome.

Since perhaps half the difficulties of peas are connected with the harvesting, it appears possible that the cultivation of types like Prussian Blue might be extended if it was found possible to harvest them with the combine harvester.

Table I.

Differences which are regarded as significant are printed in heavier type.

1930.

Station and yield per acre of control variety, threshed weight	Name of variety	Yield of grain as percentage of control, dry weight	Difference from control	Standard error of difference	Yield of straw as percentage of control, threshed weight.
CAMBRIDGE. Prussian Blue, 24·5 cwt. ...	Unica	89·8	− **10·2**	1·95	—
KIRTON. Harrison's Glory, 29·0 cwt.	Koopman's Glory	107·0	+ **7·0**	1·97	—

1931.

Station and yield per acre of control variety, threshed weight	Name of variety	Yield of grain as percentage of control, dry weight	Difference from control	Standard error of difference	Yield of straw as percentage of control, threshed weight.
CAMBRIDGE. Prussian Blue, 32·9 cwt. ...	Unica	103	+ 3	2·20	51
Dun, PN.19	P.27	92	− **8**	2·24	78
Av. 32·7 cwt.	P.50	102	+ 2	1·38	66
Black Eyed Susan, PN.25,	P.93/3	103	+ 3	5·00	100
Av. 26·4 cwt. ...	P.93/2	106	+ 6	3·58	108
Dun Composite Trial,	Dun 5	103	+ 3		88
Dun, P.N.19,	P.93/4	99	− 1		90
32·0 cwt. ...	P.87/1	96	− 4	2·87	105
	Dun 8	91	− **9**		80
	Dun 4	90	− **10**		86
KIRTON. Koopman's Glory, Av. 21·0 cwt. ...	Harrison's Glory 382	71	− **29**	2·02	—
	Harrison's Glory 424	83	− **17**	1·81	—
	Harrison's Glory selected	96	− 4	4·75	—

Table II.

1932.

Differences which are regarded as significant are printed in heavier type.

Station and yield per acre of control variety, threshed weight	Name of variety	Yield of grain as percentage of control, dry weight	Difference from control	Standard error of difference	Yield of straw as percentage of control, threshed weight
CAMBRIDGE.					
Dun 9, 27·5 cwt. ...	P.6/1A	79	**−21**	1·17	67
Black Eyed Susan, PN.29, Av. 24·4 cwt. ...	P.93/3	98	**− 2**	4·87	82
	P.93/2	106	**+ 6**	2·05	91
Composite Trial Dun, PN. 19, 31·0 cwt.	Dun 5	101	+ 1	1·78	72
	P.93/4	95	**− 5**		90
	Dun 4	95	**− 5**		60
	Dun 8	90	**−10**		75
	P.50	76	**−24**		52
Composite Trial Maple, PN.23, 27·3 cwt.	Maple 1	115	**+15**	2·93	114
	Maple 9	103	+ 3		100
	Maple PN.16	101	+ 1		80
	P.55/1	100	—		97
	Maple PN.18	99	− 1		100

1933.

Station and yield per acre of control variety, threshed weight	Name of variety	Yield of grain as percentage of control, dry weight	Difference from control	Standard error of difference	Yield of straw as percentage of control, threshed weight
CAMBRIDGE.					
Dun 9, 20·0 cwt.	P.6/1A	93	**− 7**	1·41	67
Mansholts, 12·3 cwt.	P.6/1A	150	**+50**	1·61	161
Black Eyed Susan, PN.25, 12·4 cwt.	P.93/3	150	**+50**	4·08	73
	P.93/2	150	**+50**		93
	Dun PN.19	160	**+60**		100
Composite Trial Dun, PN.19, 16·0 cwt.	Dun 5	136	**+36**	2·11	69
	P.93/4	109	**+ 9**		68
	Dun 4	134	**+34**		83
	Dun 8	127	**+27**		87
	P.50	136	**+36**		52
Composite Trial Maple, PN.23, 15·1 cwt.	Maple 1	129	**+29**	1·22	103
	Maple 9	102	+ 2		89
	P.55/1	94	**− 6**		96
	Maple 8	97	− 3		101

REPORT OF THE POTATO SYNONYM COMMITTEE

ON THE POTATOES SENT FOR IMMUNITY TRIALS TO THE POTATO TESTING STATION, ORMSKIRK, LANCASHIRE, 1934.

The following served on the Committee :—

F. J. Chittenden, F.L.S.,
W. D. Davidson, B.A., B.Sc.,
A. W. McAlister,
R. B. Strang, N.D.A.,
B. C. C. Waight,

and

Redcliffe N. Salaman, M.D., J.P. (Chairman).

Although the 1934 season was a dry one, the plots at Ormskirk, when visited by the Committee on July 17th, looked well and were in a condition to be judged with ease and certainty. Wart had only developed on a few of the susceptibles, but before the season was over the reactions were definite and corresponded with the indoor tests in the same relation as in previous years.

The year 1934 will be remembered as a turning point in the history of the Potato Testing Station by the National Institute of Agricultural Botany. For close on twenty years the Synonym Committee, acting on behalf of the National Institute of Agricultural Botany and with the support and active assistance of the trade, has been waging war on two fronts. It has fought against the practice of cataloguing old stocks under new names on the one hand, and against the attempt to introduce old stocks as new creations, on the other. It is in respect to this latter aspect of the struggle that we have this year to record a final success. When the Synonym Committee reported in 1919, no fewer than 75 per cent. of the total entries sent to Ormskirk for the testing of their susceptibility to wart and their suitability as new productions for the market, were merely old stocks with new names. This year, of every one of the 84 entrants not one proved to be other than a new and original production.

On the other front, victory still lingers. The same firms, with a persistence worthy of a better cause, advertise in their catalogues the same old stocks under the same aliases. Seeing that of the 23 of such synonymous stocks purchased, 6 were samples of Up-to-Date, 4 of Duke of York, 3 of Sharpe's Express, 2 of British Queen, 2 of Eclipse, 1 of King Edward and 1 of Red King Edward — all easily recognized varieties — it would appear that the seedsmen involved are trusting to the ignorance of their clients.

We notice that the firms at fault have not changed their methods; the same stock may be sold under its true name at one price, and under its fancy name at an enhanced one. This year is no exception. Thus,

a quite nice stock of Great Scot is offered at 1/9d. for 14 lb., whilst the same firm catalogues its synonym, Dreadnought, at 3/-. A stock of British Queen with considerable virus infection is priced at 1/6d. for 14 lb., but a stock of English Beauty, the same variety, is priced at 2/6d. An interesting example of these vagaries is the following : A stock of Up-to-Date is offered for 6/- for 14 lb., whilst the same firm puts a stock of the same variety on the market under two distinct names, viz., Longkeeper and Factor, at 4/6d.

A noticeable feature of some of these stocks is the number of rogues in them. Thus, Early Favourite, which we have several times declared to be Sharpe's Express, this year contained 10 per cent. of Duke of York. On the other hand, the Up-to-Date of one firm contained 10 per cent. of rogues, which was more than its synonym Prosperity did.

Surely the time is long overdue when "this fooling should cease." To-day there is no room to plead ignorance; the great majority of seedsmen have denounced the practice and refused longer to be a party to its use. Are we to wait till the law pronounces once and for all against a practice which injures the public and sullies the good name of a very honourable industry?

The list of firms from whom stocks were purchased is given on p. 56 : it contains practically an identical list of synonyms issued by the same dealers as last year.

The following groups of entries have been examined :—

1 stock too mixed to be judged.
3 stocks too poor to be judged.
18 Inter-departmental Check varieties, i e.
  15 distinct and free from wart disease.
  3 duplicates of others sent for test.
3 distinct varieties susceptible to wart disease.
62 distinct varieties free from wart disease.

The Committee have great pleasure in recording the excellent work that, as in previous years, Mr. Bryan and Mrs. McDermott have accomplished. They take this opportunity also of expressing their appreciation of the good work of Mr. Sharrock, the foreman.

(Signed on behalf of the Committee),

REDCLIFFE N. SALAMAN.

I. STOCK TOO MIXED TO BE JUDGED.

No. of plot	Variety	Name of sender	Incidence of wart disease
48	B. 6/30	Dobbie & Co. Ltd., Edinburgh	No wart seen

II. STOCKS TOO POOR TO BE JUDGED.

53	81/17	E. Webb & Sons Ltd., Stourbridge	No wart seen
112	967c (38)	Scottish Society for Research in Plant Breeding, Corstorphine	" " "
119	Derrick	J. Sumner, Bickerstaffe, Ormskirk	" " "

III. INTER-DEPARTMENTAL CHECKS.

DISTINCT VARIETIES.

122	281 J. Clarke	Dept. of Agriculture for Northern Ireland	No wart seen
123	282 J. Clarke	ditto	" " "
124	283 J. Clarke	ditto	" " "
125	310 J. Clarke	ditto	" " "
126	326 J. Clarke	ditto	" " "
128	D.9 (9) S.S.R.P.B.	Dept. of Agriculture for Scotland	" " "
130	151 (80) S.S.R.P.B.	ditto	" " "
131	967c (38) S.S.R.P.B.	ditto	" " "
132	A.178 Pollock	ditto	" " "
134	Pittendrigh 2	ditto	" " "
135	Pittendrigh 8	ditto	" " "
137	L.101 Findlay	ditto	" " "
138	Stuart A	ditto	" " "
139	W.B.1 Brown	ditto	" " "
140	No. 4 Milne	ditto	" " "
		Duplicate of plot No. 108	
129	151 (39) S.S.R.P.B.	Dept. of Agriculture for Scotland	" " "
		Duplicate of plot No. 104	
133	762 Pollock	Dept. of Agriculture for Scotland	" " "
		Duplicate of plot No. 87	
136	A.13 Spence	Dept. of Agriculture for Scotland	" " "

IV. DISTINCT VARIETIES SUSCEPTIBLE TO WART DISEASE.

77	184/18	D. MacKelvie, Lamlash	Wart present
116	D.11/31	Dobbie & Co. Ltd., Edinburgh	" "
117	May Queen Seedling	ditto	" "

V. DISTINCT VARIETIES FREE FROM WART DISEASE IN THE FIELD.

SECOND YEAR STOCKS.

2	R. 50	C. T. Spence, Dunbar
4	L. 89	ditto
6	U.A. 98	ditto
8	138 (69)	Scottish Society for Research in Plant Breeding, Corstorphine
11	5104	Sutton & Sons Ltd., Reading
13	5110	ditto
15	5121	ditto
17	5130	ditto
19	5133	ditto
21	5146	ditto

DISTINCT VARIETIES FREE FROM WART DISEASE—continued.

No. of plot	Variety	Name of sender
SECOND YEAR STOCKS.—Continued.		
24	156/16	D. MacKelvie, Lamlash
26	180/42	ditto
28	193/24	ditto
30	193/28	ditto
33	193/38	ditto
35	193/63	ditto
37	C.M. 63	J. Chisholm, Huntly, Aberdeenshire
41	C.M. 72	ditto
43	C.M. 75	ditto
45	5298	McGill & Smith Ltd., Ayr
49a	B. 8/30	Dobbie & Co. Ltd., Edinburgh
51	W. 1	E. Webb & Sons Ltd., Stourbridge
55	Red Letter	Wm. B. Pollock, Bishopton, Renfrewshire
58	C.T.S. No. 1	Carter's Tested Seeds Ltd., London
FIRST YEAR STOCKS.		
61	1309	McGill & Smith Ltd., Ayr
63	9306	ditto
64	8303	ditto
66	103021	ditto
67	10319	ditto
69	9311	ditto
70	10313	ditto
72	5313	ditto
73	9298	ditto
74	180/27	D. MacKelvie, Lamlash
76	183/15	ditto
78	193/10	ditto
80	193/23	ditto
82	193/40	ditto
83	193/89	ditto
84	193/101	ditto
85	202/10	ditto
86	203/10	ditto
87	A.13	C. T. Spence, Dunbar
88	A.17	ditto
89	A.21	ditto
91	B.62	ditto
92	E.13	ditto
94	E.53	ditto
96	5111	Sutton & Sons Ltd., Reading
97	5137	ditto
98	5140	ditto
100	5146	ditto
101	5166	ditto
102	A.182	Wm. B. Pollock, Bishopton, Renfrewshire
103	544	ditto
104	762	ditto
106	134 (5)	Scottish Society for Research in Plant Breeding, Corstorphine
108	151 (39)	ditto
109	189a (73)	ditto
110	212a (30)	ditto
113	D. 3/31	Dobbie & Co. Ltd., Edinburgh
114	D. 6/31	ditto

REPORT ON PURCHASED STOCKS OF SYNONYMS, 1934.

Name under which stock was purchased.	Vendor.	Result of examination in 1934. Synonymous with	When previously tested found to be synonymous with
Chester Early	McHattie & Co., Chester	Duke of York	Duke of York
Victory	Tillie, Whyte & Benvie, Edinburgh	Duke of York	Duke of York
Queen of the Earlies	Baker, Codsall, near Wolverhampton	Duke of York	Duke of York
Cherub	D. & W. Croll, Ltd., Dundee	Duke of York	Duke of York
First Crop	Carter's Tested Seeds Ltd., London	Sharpe's Victor	Sharpe's Victor
Express	E. Webb and Sons (Stourbridge) Ltd., Stourbridge	Sharpe's Express	Sharpe's Express
Earliest of All	J. E. Knight & Son, Wolverhampton	Sharpe's Express	Sharpe's Express
Early Favourite	S. Finney & Co., Ltd., Newcastle-on-Tyne	Sharpe's Express	Sharpe's Express
Advancer	Carter's Tested Seeds Ltd., London	Eclipse	Eclipse and Bishop
Colonist	E. Webb and Sons (Stourbridge) Ltd., Stourbridge	Eclipse	Eclipse
Dreadnought	J. E. Knight & Son, Wolverhampton	Great Scot	Great Scot
English Beauty	Stuart & Mein, Kelso	British Queen	British Queen
Royalty	Carter's Tested Seeds Ltd., London	British Queen	British Queen
Cleadon Park	S. Finney & Co., Ltd., Newcastle-on-Tyne	Red King Edward VII	Red King Edward VII
Mons Star	C. M. Haigh, Chatteris, Cambs.	King Edward VII	No stocks have been purchased from this firm previously.
Renown	E. Webb and Sons (Stourbridge) Ltd., Stourbridge	Abundance	Abundance
Prosperity	ditto	Up-to-Date	Up-to-Date
Scottish Triumph	McHattie & Co., Chester	Up-to-Date	This synonym has not been purchased from this firm previously.
Tremendous	Toogood & Sons Ltd., Southampton	Up-to-Date	Up-to-Date
Sensation	Daniel Bros., Norwich	Up-to-Date	Up-to-Date
Longkeeper	Carter's Tested Seeds Ltd., London	Up-to-Date	Up-to-Date
Factor	ditto	Up-to-Date	Up-to-Date
Mein's Chieftain	Stuart & Mein, Kelso	The Towse (Climax)	The Towse (Climax)

CEREAL SYNONYMS.

The Cereal Synonym Committee, appointed by the Royal Agricultural Society of England, the National Farmers' Union, the Agricultural Seed Trade Association, the National Association of Corn and Agricultural Merchants, the Cambridge University Plant Breeding Institute, and the National Institute of Agricultural Botany, have come to the following decisions on the stocks of cereals which they examined in 1934 and 1935. This summary of the reports is issued by the National Institute of Agricultural Botany in compliance with the request of the Committee that as much publicity as possible should be given to their decisions.

In arriving at their decisions the Committee were guided by the following definition of a cereal synonym :—

> " The Cereal Synonym Committee regard two cereals as synonymous when they present precisely similar morphological characters, and when they also possess identical physiological characters in so far as they can be determined. Even then by this term they do not necessarily imply that these two varieties are of identical origin, though doubtless in the majority of cases they are. The possibility of two cereals of different parentage presenting such a close, if not complete, similarity as to mask their individuality has not been lost sight of. But the Committee have to deal with facts as they are; they, therefore, regard as synonymous all cereals which are identical in the sense used above even when they know that the origins are different.
>
> *Note.*—Before the Committee come to a conclusion concerning the synonymity of any variety the breeder and-or the introducer is given an opportunity of demonstrating to the Committee such differences as he may claim to exist between his variety and the type variety."

Using the term " synonym " in the above sense the Committee are of the opinion that the names listed below in the left hand column are synonyms of those in the right hand column.

1934.

WHEAT.

James Carter & Co.'s	Corn in Egypt is a synonym of SETTER.

OATS.

James Carter & Co.'s	Quite Content is a synonym of VICTORY.
,, ,, ,,	Harvester 1926 ,, ,, ,, SUPERB.
Edward Webb & Sons (Stourbridge) Ltd.'s	White Horse ,, ,, ,, VICTORY.
,, ,, ,,	Ascot, 1933 stock* ,, ,, RECORD.
,, ,, ,,	Ascot, 1934 stock ,, ,, VICTORY.

* Stock mixed but predominantly Record.

The Committee understand that Harvester 1926 will not be offered for sale in the future.

In response to enquiries from farmers and seedsmen, the Committee gave careful attention to the question of Victor and Wilhelmina. They examined two stocks of Victor and two of Wilhelmina and considered evidence concerning Wilhelmina from Dutch authorities. They came to the following conclusions :—

Wilhelmina consists of a number of strains. These strains are very similar and are only separated satisfactorily by means of the phenol reaction. The predominant strains grown in Holland give a dark brown coloration either uniform or more or less spotted. Only 1 per cent. of Dutch samples have as little as 10 per cent. of grains giving a brown coloration.

The two stocks of Victor were alike and could be distinguished from Wilhelmina by means of the phenol reaction. They gave a predominantly pale colour with phenol. Only a few grains gave a dark reaction.

In view of the morphological similarity of these wheats there is little doubt that they are easily confused in commerce, but they cannot be regarded as identical, or therefore as synonyms.

1935.

WHEAT.

Harold Sadd's Seeds Ltd.'s (Ipswich)	Standfast Yielder is a slightly improved stock of BACTON MASTERPIECE.

OATS.

Edward Webb & Sons Stourbridge) Ltd.'s	Ascot (1935 stock) is a synonym of RECORD.
John Swain Ltd.'s (Bristol)	January White Oat ,, ,, VICTORY.

This oat is claimed to be a hardy selection from Victory. The Committee have given particular attention to hardiness, but are unable to confirm the claim that January White is superior to Victory in this respect.

BARLEY.

Herbert Parker Ltd.'s (Norwich)	Norfolk Malting is a synonym of SPRATT-ARCHER.

LORD DERBY GOLD MEDAL TRIALS, 1935.

H. BRYAN, B.Sc.

There were four entries for the Gold Medal trials in 1935, namely Alness, sent by the Scottish Society for Research in Plantbreeding; Gladstone, sent by Messrs. McGill & Smith Ltd. of Ayr; seedling 193/63, sent by Mr. D. MacKelvie of Lamlash, Isle of Arran; and Duke of Kent, sent by Messrs. Sutton & Sons of Reading.

The trials were carried out at the Potato Testing Station, Ormskirk, on soil typical of the potato growing land of the district. Each variety was tested as far as possible against established varieties of its own season of maturity and tuber shape.

The trials consisted of eight randomized single drill plots of each variety and its controls. The drills, which were set 28 inches apart, consisted usually of 50 cut setts with 16 inch spacing. The best manurial practice of the district was followed. A large single plot of each variety was planted to enable the practical growers to form an opinion of each entry whilst growing.

The Committee inspected the trials a number of times during the growing season and in addition many visits were made by individual members of the Committee, on which the Institute is represented.

This year in the case of the seed of the varieties under test and their controls, all stocks were described as very good, there being a complete absence of any form of rot, scab, spraing or blight. As it is known that the size of the seed affects the size of the crop and also the size of the ware potatoes, every attempt was made to arrange that the size of the seed of each variety and its controls was approximately the same, but owing to the small stock of seed of the new varieties this procedure was not always successful. As certain varieties sprout more rapidly than others under equal conditions, the lengths of the sprouts of the stocks usually varied when planted.

The produce of all stocks in the trials was riddled over the size of mesh prescribed at the time of lifting by the Potato Marketing Board. In all cases this year the riddle used was 1⅝ inches.

As in other years, cooking tests of the entries were carried out at the Research Laboratories of Messrs. J. Lyons & Co. Ltd. The Committee wish once more to record their appreciation of this essential factor in the trials.

SECOND-EARLY TRIAL.

ALNESS.

The control varieties used were Arran Comrade and British Queen. The trial was planted on the 11th April, when the tubers of all varieties were slightly sprouted. The trial grew normally until the end of July, when it was

severely buffeted by strong winds, a factor which hastened the maturity of all the stocks, and as a result yields were low.

The stock of British Queen was ostensibly virus free; two plants with mosaic were detected in the Arran Comrade stock, and six plants with secondary leaf-roll in the Alness. The appearance of the secondary form of virus diseases in the stock of the new variety was regarded as a serious fault.

The Committee were not impressed with the growth of Alness, which was not as robust as that of the standard second-early British Queen, and which developed a pronounced straggling habit. Judging by the time of maturity of the foliage Alness must be regarded as an early second-early, and like Arran Comrade all plants were mature by the 12th August. British Queen on the other hand was not mature until the 26th August.

YIELD.

The total yields of Alness, Arran Comrade and British Queen were very similar, amounting to 8.8, 8.6 and 9.9 tons per acre. The proportions of ware were also alike, and the ware yields were 6.0, 5.8 and 5.9 tons per acre.

GENERAL.

The presence of secondary virus disease, the time of maturity and the straggling habit of growth of Alness did not impress the Committee, who felt that whatever the state of the market the variety would have to be lifted and could not be left in the ground to serve as a winter potato, as can Arran Banner, Great Scot and Majestic, which serve both as winter potatoes and second-earlies in Lancashire. The produce of Alness was inconsistent in shape, the tubers being round to oval. In view of these considerations the Committee decided to make no award.

DESCRIPTION OF ALNESS.

Sprout : Pink.

Tuber : Round to oval; skin white, flesh white; eyes shallow.

Foliage : Medium height, spreading; leaf erect; leaflets broad, margins slightly fluted, yellowish-green, terminal leaflet well clear of last pair of laterals; secondary leaflets small; wings slightly serrated; stems green.

Flowers : White; strong stalk; orange anthers; dark buds; berries occur.

Maturity : Early second-early.

EARLY MAINCROP TRIAL.

GLADSTONE.

The control varieties used in this trial were King Edward and Majestic. The trial was planted on the 9th April. The sprouts of Gladstone were considerably longer than those of King Edward and Majestic, the stock of the latter variety not being received until the end of March.

The plants developed normally and being planted in a sheltered position escaped the effects of the May frosts and the strong winds occurring in July. All stocks were ostensibly free from virus diseases.

Plants from the surplus plots of the three varieties were lifted from the beginning of August onwards, and throughout the produce of Gladstone compared favourably with that of King Edward. The Committee were particularly attracted by the shape of the tubers and by the distinctive pink splashings on the skin. Towards maturity the leaflets developed a form of roll variously known as " soft roll " and " maturity rolling ", but there was no trace of genuine leaf-roll. The Committee were fortunate in being able to inspect a field of this variety growing under commercial conditions in the district, and no true leaf-roll was detected in this stock.

As regards maturity of the foliage, Gladstone appears to come between King Edward and Majestic. In the trial itself, however, owing to weather conditions Gladstone matured at the same time as King Edward. The Gladstone and King Edward plots were lifted on the 25th and 26th August, those of Majestic on the 16th September. In the case of this trial sufficient seed was available to plant 70 cut setts per drill instead of the usual 50.

YIELD.

	Total yield tons per acre	Yield of ware tons per acre	Percentage ware
Gladstone	9·5	8·1	84
King Edward	10·4	7·7	74
Majestic	13·0	11·2	87
Significant difference ...	0·5	0·6	—

Gladstone produced a comparatively high proportion of ware-sized tubers, and although its total yield was lower than those of its controls, the yield of ware was similar to that of King Edward.

GENERAL.

In the opinion of the Gold Medal Committee the sample of Gladstone ware was more attractive than that of King Edward, the tubers being more consistent in shape and size; second-growth was entirely absent. The tubers of Gladstone were oval to kidney in shape, the eyes shallow, the skin white with red blotches, and the colouring somewhat similar to that of King Edward.

As the expert report received from Messrs. J. Lyons & Co. Ltd. stated that the cooking qualities of Gladstone were outstanding, being equal to King Edward when fried and better when steamed, thus confirming numerous private tests, the Committee unanimously decided to award a Gold Medal to this variety.

Spraing was this year prevalent in a number of varieties on the trial grounds and it was noticed that it developed rather extensively in Gladstone after three weeks' storage, but none was detected in King Edward. It was present in the Majestic tubers but was not so pronounced as in Gladstone. Although spraing is known to occur more frequently in dry years and on light sandy soils, yet the Committee felt that so little was known about the defect that it would be unreasonable to withhold an award merely because it developed intensively in a single trial. Some hundreds of tubers were obtained from the crop of Gladstone growing on a commercial scale a few miles from the trial grounds. These tubers were stored for five weeks and then cut, when no trace of spraing was observed. No reports have been received of its occurrence in any crop of this variety in Scotland or elsewhere.

DESCRIPTION OF GLADSTONE.

Sprout : Pink.
Tuber : Oval to kidney; skin white with red blotches; flesh white; eyes shallow, red.
Foliage : Moderately tall, vigorous, upright, spreading towards maturity; colour dark green; leaf open, arched; leaflets fairly small, terminal leaflet drooping to perpendicular, soft, wrinkled, glossy; secondary leaflets fairly small and numerous; wings straight; stems green.
Flowers : Very large, white, numerous, clustered; orange anthers.
Maturity : Early maincrop.

LATE MAINCROP TRIAL.

SEEDLING 193/63.

The trial was planted on the 10th April, when the tubers of all stocks were slightly sprouted. The control varieties used were Arran Consul and Up-to-Date. The trial grew normally until the first week in August when Seedling 193/63 was found to be suffering from the effects of strong winds and the drought to a greater extent than its control varieties, the effect becoming more pronounced as the season advanced. By the 7th September the foliage was completely withered, whereas the control varieties were still green and were not considered mature until the beginning of October. The stocks of 193/63 and Arran Consul were ostensibly virus free; the Up-to-Date proved not to be a very good stock. 4·9 per cent. of secondary leaf-roll was present, in addition to which three plants with crinkle were detected.

YIELD.

	Total yield tons per acre	Yield of ware tons per acre	Percentage ware
193/63	10·9	8·5	78
Up-to-Date	12·2	9·1	75
Arran Consul	10·8	9·5	88
Significant difference ...	1·0	—	—

The variety did not differ significantly in yield of ware from its controls. Its total yield was similar to that of Arran Consul. Both were outyielded by Up-to-Date.

GENERAL.

The behaviour of Seedling 193/63 in the immunity trials in 1933 and 1934 was outstanding and it is known that remarkable crops have been obtained from this variety during 1935 in Scotland. The tubers were oval in shape somewhat resembling Up-to-Date; the foliage was of the desirable commercial type. The cooking report received from Messrs. J. Lyons and Co. Ltd. was good, but points were lost through discoloration which occurred on steaming.

As small sized plots of potatoes with paths around them are more susceptible to weather effects than whole fields of potatoes and in view of the fact that the yield results were remarkably good under such conditions, the Committee unanimously agreed that further information was desirable and decided to allow Seedling 193/63 to be entered again in 1936 without payment of fee.

DESCRIPTION OF SEEDLING 193/63.

Sprout : Blue.
Tuber : Oval ; skin white with slight tinge of colour at heel ; flesh white ; eyes shallow ; stolons with slight tinge of colour.
Foliage : Medium height, strong ; colour dark green ; intermediate leaf, arched ; leaflets medium size, wrinkled ; wings serrated ; stems with deep purple colouration.
Flowers : White, numerous, stalks slender ; buds coloured ; deep orange anthers.
Maturity : Late maincrop.

LATE MAINCROP TRIAL.

DUKE OF KENT.

The control variety used was Kerr's Pink. The trial was planted on the 10th April, the tubers of Kerr's Pink being slightly sprouted. Owing to the late arrival of the stock of Duke of Kent the tubers were not sprouted.

The trial grew normally and was but little affected by the weather conditions.

The foliage of Duke of Kent was strong and bushy, the leaflets were large, affording good cover, and in the opinion of the Committee was the ideal commercial haulm. No virus disease was seen in either stock. It was apparent from the trial that Duke of Kent is slightly earlier than Kerr's Pink in maturity. Duke of Kent was lifted on the 4th October and Kerr's Pink on the 7th October.

YIELD.

The variety did not differ significantly in total yield from its control, but it produced a higher proportion of ware, amounting to 90 per cent. as compared with 85 per cent. for Kerr's Pink, and it gave a greater yield of ware, the figures being 10·8 and 10·7 tons per acre respectively.

GENERAL.

The appearance of the produce of Duke of Kent was outstanding when compared with that of Kerr's Pink, second-growth which was prevalent in the latter variety being absent. The tubers were remarkably even in size and shape, a character which was apparent on lifting.

In the view of the Committee this was one of the best round varieties they had examined for a number of years. Unfortunately the cooking tests were not satisfactory, discolouration on steaming being pronounced. The Committee were not sure whether this defect was varietal or due to the Ormskirk conditions, and in view of the other excellent characteristics of the variety they decided to allow a further test next year in some other potato growing district as well as at Ormskirk without payment of fee.

DESCRIPTION OF DUKE OF KENT.

Sprout : Pink.
Tuber : Round ; skin white ; flesh white ; eyes medium.
Foliage : Tall, strong, bushy ; colour dark green ; leaf long, arched ; leaflets large, waxy appearance ; secondary leaflets large ; wings crinkled ; stems green.
Flowers : White, numerous ; green buds ; orange anthers.
Maturity : Late maincrop.

POTATO TRIALS, 1934 - 1935

B. BRANDRETH, B.A.

I. THE EFFECT OF SIZE OF " SEED " ON THE YIELDS OF THE LARGER GRADES OF WARE POTATOES.

INTRODUCTION.

Previous investigations, and notably those of Salaman(1) and Wallace and Thompson(2) have established a relationship between the size of seed potatoes and both the total yield and the proportion of " ware " produced. It has been shown that within certain limits a large sett tends to produce a heavier yielding plant than a small sett, but that the crop produced by small seed is made up of larger tubers. Both factors must therefore be taken into account when considering the size of seed which can most profitably be employed and the results of trials indicate that, for certain varieties, setts weighing between 2 and 3 oz. are likely to give the heaviest yield of ware.

As far as can be ascertained, no previous experiments have been carried out to discover whether 2 - 3 oz. seed, which is here referred to as " medium " seed, would also produce the most profitable results when the ware potatoes were dressed over a number of different sizes of riddle. This point has assumed some importance in view of the regulation of riddle sizes by the Potato Marketing Board. A trial was accordingly carried out in 1934 by the Potato Testing Station to examine the effect of size of seed on the yield of ware potatoes, the ware being dressed over several sizes of riddle.

There was some evidence from a trial carried out at Ormskirk in 1930(3) that the use of cut setts led to an increase in the proportion of ware in the crop, and cut setts were therefore included in the trial.

METHOD OF TRIAL.

The trial was carried out at Ormskirk on a light sandy loam. Scotch seed of Majestic was supplied by the grower in three grades. These will be referred to as large, medium and small, and contained tubers of an average weight of 5, $2\frac{1}{2}$ and $1\frac{1}{2}$ oz. respectively.

The seed was of excellent quality and was boxed on the 20th March. At the time of planting a part of the large seed was cut into halves and another part into quarters, the cuts being made longitudinally. These setts will be referred to throughout simply as halved and quartered seed. The use of cut setts is general in the Ormskirk district, and, as in this case, no special precautions are taken to avoid exposure of the cut surface.

The classes of setts tested were therefore the following :—

Large,	with	an	average weight	of	5 oz.
Medium,	,,	,,	,,	,,	$2\frac{1}{2}$,,
Small	,,	,,	,,	,,	$1\frac{1}{2}$,,
Halved	,,	,,	,,	,,	$2\frac{1}{2}$,,
Quartered	,,	,,	,,	,,	$1\frac{1}{4}$,,

The trial consisted of eight blocks each containing a randomized single drill plot of each class of seed. The drills were 27 inches apart and contained 72 setts planted at a distance of 16 inches.

The previous crop was one of seeds hay; farmyard manure was applied at the rate of 16 - 18 tons per acre and at the time of planting the trial area received a dressing of 3 cwt. per acre of artificials containing equal parts of superphosphates, sulphate of potash and sulphate of ammonia. Planting took place on the 12th April and subsequent cultivations were in accordance with the best practice of the Ormskirk district.

In the early stages the plants produced by the large setts appeared to be the most vigorous, owing to the production of a greater number of shoots; the growth of the plants from the quartered setts was irregular. However, by mid-July no difference could be seen in the growth of any of the plots.

Ten " misses " (1·7 per cent.) occurred in the plots containing quartered setts, two and four respectively in the medium and small setts, and none in the other two classes. No trace of disease of any description was observed.

The plots matured together and were lifted between the 8th and 11th October, the produce being dressed over $1\frac{5}{8}''$, $1\frac{3}{4}''$ and $2''$ riddles. No attempt was made to separate the smaller potatoes into " seed " and " chats ".

RESULTS.

YIELD PER ACRE.

Figures showing the total yield per acre as well as the yields of different grades of ware are given in Table I. The categories " total ware ", " large ware " and " extra large ware " include the whole of the produce remaining on horizontal riddles with meshes of $1\frac{5}{8}''$, $1\frac{3}{4}''$ and $2''$ respectively. It is felt that these figures will be more readily applicable than those showing the yields of ware between $1\frac{5}{8}''$ and $1\frac{3}{4}''$ or $1\frac{3}{4}''$ and $2''$. In any case, the latter will be found under the heading " Reduction in yield due to increase in size of riddle ".

Table I.

TOTAL YIELD AND YIELD OF WARE
(tons per acre).

Seed	Total Yield	Ware		
		Over $1\frac{5}{8}''$	Over $1\frac{3}{4}''$	Over $2''$
5 oz. tubers (whole) ...	16·7	14·3	12·6	11·3
$2\frac{1}{2}$ oz. tubers	16·4	14·4	13·3	12·4
5 oz. tubers in halves ...	15·3	13·3	12·1	11·1
$1\frac{1}{2}$ oz. tubers	14·5	12·7	11·9	10·8
5 oz. tubers in quarters ...	13·8	12·5	11·9	11·2
Standard error ...	±0·35	±0·34	±0·35	±0·37
Significant difference ...	±1·0	±1·0	±1·0	(±1·1)

Total Yield. The large and medium setts produced similar total yields and both significantly outyielded the small, halved and quartered setts. Of the latter, the halved outyielded the quartered setts, but the other differences were not significant.

Total Ware. When dressed over a 1⅝″ riddle the relations between the yields of ware were similar to those between the total yields. It will be seen from Fig. I that the relative differences were smaller.

Large Ware. The effect of increasing the size of riddle to 1¾″ is clearly shown in Fig I. The superiority of the yield from medium seed over those from small seed and from cut setts was maintained; medium seed also outyielded large seed, though the difference escaped significance. There were no significant differences between the yields of large ware from large, small, halved or quartered setts.

Extra Large Ware. The trend of the yields of total ware and large ware was continued when the produce was dressed over a 2″ riddle. Medium seed now outyielded all other setts significantly, while there were no significant differences between the latter. Large seed produced similar yields of extra large ware whether planted whole, halved or quartered.

PROPORTION OF WARE PRODUCE.

Table II contains the percentages of the different grades of ware produced by the various seed sizes. While these figures are of secondary practical importance it is significant that the smaller seed tubers not only produced a greater proportion of ware, but that this proportion itself contained a higher percentage of the larger grades.

Table II.

PROPORTION OF WARE POTATOES.

Seed	Precentage of " ware "		
	Over 1⅝″	Over 1¾″	Over 2″
5 oz. tubers in quarters ...	90·7	85·9	80·9
1½ oz. tubers	88·1	82·1	75·0
2½ oz. tubers	87·7	81·4	75·7
5 oz. tubers in halves ...	86·8	79·1	72·6
5 oz. tubers (whole) ...	85·5	75·4	67·9
Standard error ...	±0·62	±0·91	±1·18
Significant difference ...	±1·8	±2·6	±3·4

REDUCTION IN YIELD DUE TO INCREASE IN SIZE OF RIDDLE.

It must be emphasized that the size of any reduction in yield under this heading is largely dependent on environmental factors and that the figures contained in Table III apply to a single trial. At the same time, there is little reason to doubt that the relation between the yields of different grades of ware from the various sizes of seed is generally applicable to Majestic.

Figure 1

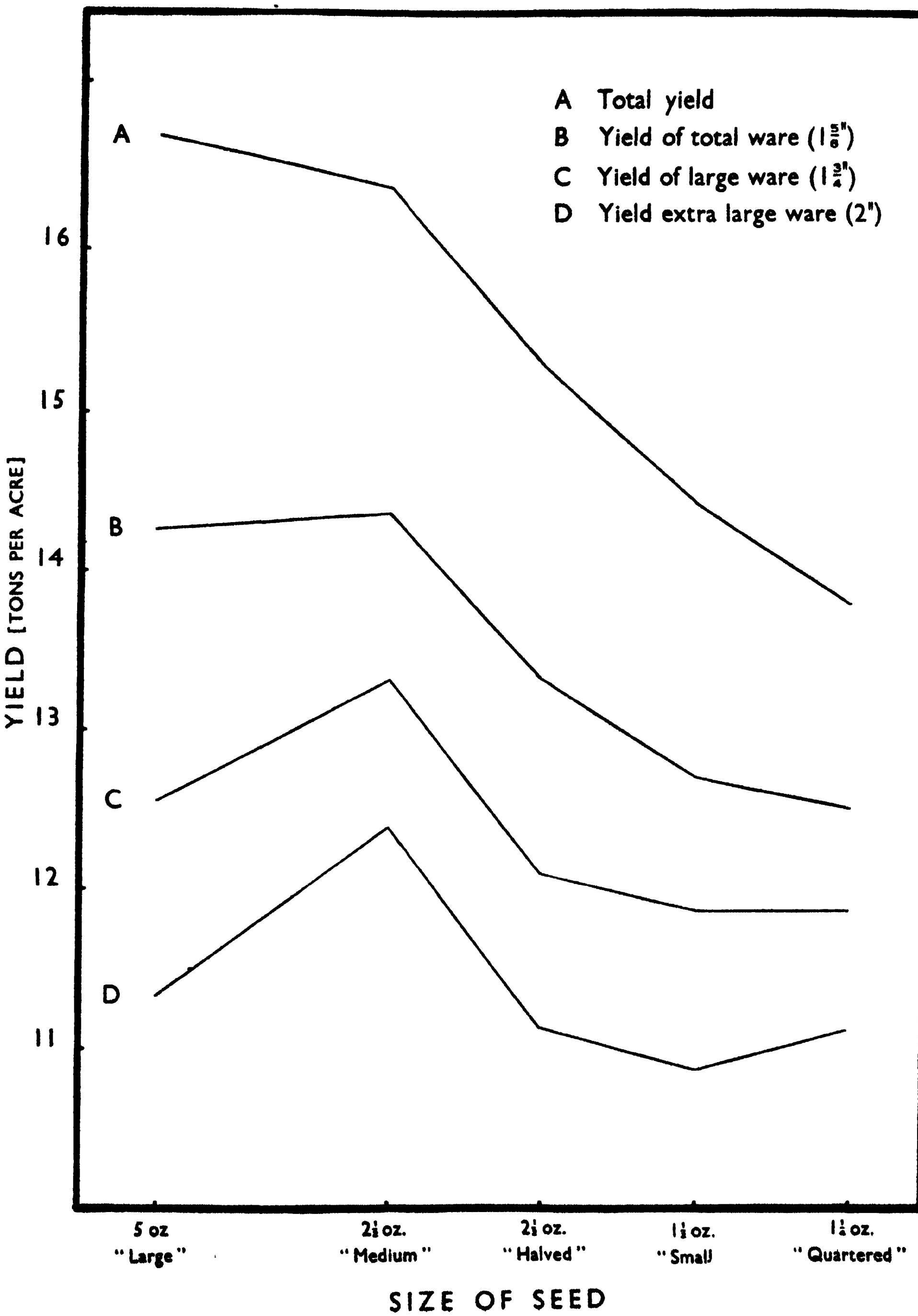

A Total yield
B Yield of total ware ($1\frac{5}{8}$")
C Yield of large ware ($1\frac{3}{4}$")
D Yield extra large ware (2")
A
B
C
D
16
15
14
13
12
11
YIELD [TONS PER ACRE]
5 oz "Large"
2½ oz. "Medium"
2½ oz. "Halved"
1½ oz. "Small"
1¼ oz. "Quartered"
SIZE OF SEED

Table III.

Seed	Yield of total ware (1⅝″) Tons per acre	Reduction in yield due to increase in size of riddle. From 1⅝″ — 1¾″ Tons per acre	From 1⅝″ — 1¾″ % of yield of 1⅝″ ware	From 1¾″ — 2″ Tons per acre	From 1¾″ — 2″ % of yield of 1⅝″ ware	Yield of ware over 2″ riddle Tons per acre
Medium	14·4	1·0	7·1	0·9	6·5	12·4
Large	14·3	1·7	11·8	1·3	8·8	11·3
Halved	13·3	1·2	8·9	1·0	7·5	11·1
Small	12·7	0·9	6·8	1·0	8·0	10·8
Quartered	12·5	0·7	5·3	0·7	5·5	11·2
Standard error	±0·34	±0·10	±0·7	±0·13	±0·9	±0·37
Significant difference	±1·00	±0·3	±2·2	±0·4	±2·7	±1·1

As regards the reduction in yield due to the first increase in size of riddle, it is seen that the yield from large seed was more heavily reduced than that from any other class of sett and that the reduction with quartered seed was smaller than in any other case. No other difference was significant.

When the size of riddle was raised to 2″, large seed again showed the heaviest reduction, but it was not significantly greater than any other, nor in fact were any significant differences shown. This was largely due to the erratic behaviour of the yield from the small whole seed, as may be seen from the table.

It is of interest that the effect of increasing the size of riddle from 1⅝″ to 1¾″ and from 1¾″ to 2″ was in each case to reduce the yield of ware from the medium, small and halved seed by rather less than one ton per acre, or by roughly 8 per cent. of the "total" ware yield.

COMMERCIAL VALUE OF CROP.

The chief value of the trial lay in its providing some indication of the effect of riddle regulation on the value of the crop and Tables IV A, B and C contain figures showing the relative returns to the grower.

Table IV A.

VALUE OF CROP
(Ware dressed over 1⅝″).

Class of seed	Cost of seed	Value of ware	Value of surplus	Net value of total crop	Net value of ware
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Large ...	10 3 0	49 17 6	2 8 5	42 2 11	39 14 6
Medium ...	7 1 5	50 5 2	2 0 5	45 4 2	43 3 9
Small ...	5 3 9	44 11 1	1 14 5	41 1 9	39 7 4
Halved ...	5 1 6	46 11 8	2 0 5	43 10 7	41 10 2
Quartered	2 10 9	43 17 1	1 5 10	42 12 2	41 6 4

Table IV B.

VALUE OF CROP

(Ware dressed over $1\frac{3}{4}''$).

Class of seed	Cost of seed	Value of ware	Value of surplus	Net value of total crop	Net value of ware
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Large ...	10 3 0	43 19 11	4 2 0	37 18 11	33 16 11
Medium ...	7 1 5	46 13 10	3 0 10	42 13 3	39 12 5
Small ...	5 3 9	41 10 2	2 11 10	38 18 3	36 6 5
Halved ..	5 1 6	42 9 1	3 4 0	40 11 7	37 7 7
Quartered	2 10 9	41 10 11	1 19 0	40 19 2	39 0 2

Table IV C.

VALUE OF CROP

(Ware dressed over $2''$).

Class of seed	Cost of seed	Value of ware	Value of surplus	Net value of total crop	Net value of ware
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Large ...	10 3 0	39 12 5	5 7 0	34 16 5	29 9 5
Medium .	7 1 5	43 8 0	3 19 7	40 6 2	36 6 7
Small ...	5 3 9	37 18 10	3 12 2	36 7 3	32 15 1
Halved	5 1 6	38 19 1	4 4 0	38 1 7	33 17 7
Quartered	2 10 9	39 2 7	2 12 10	39 4 8	36 11 10

In order to obtain these figures the seed was charged at £5, £7, and £8 10s. 0d. per ton for the 5 oz., $2\frac{1}{2}$ oz. and $1\frac{1}{2}$ oz. grades respectively. The weight of seed planted per acre in each of the various classes was as follows :—

Large	2·03 tons
Medium	1·01 ,,
Small	0·61 ,,
Halved	1·01 ,,
Quartered	0·51 ,,

No grower would in fact plant so large a quantity as that of the large grade and the yields obtained show that the planting of this amount is unjustified unless a market can be found for the smaller produce as seed.

It has been assumed that the crop has been grown for ware only and that the surplus produce was sold or used for feeding stock. The ware has been valued at £3 10s. 0d. per ton throughout and the surplus at £1 per ton. Where the surplus tubers are large in size they will also be large in numbers and their value will be depressed, but it is probable that in such a case a larger proportion would be used for seed. In any case it is impossible to do more than to assign an arbitrary value to them.

"Medium" seed (2½ oz.) gave the highest total cash return per acre, although where no commercial value was assigned to the surplus after riddling, the use of quartered seed was equally profitable. The latter owes its good showing largely to the low initial cost of the seed.

The net value of ware grown from the various sizes of seed is shown graphically in Fig II.

It is perhaps necessary to mention that yields obtained in trials are generally higher than those to be expected under farming conditions and the value of the crop is correspondingly greater. It is unlikely however that this point will affect the relative returns from the various grades of seed.

SUMMARY.

The crops of ware potatoes produced by five classes of "seed" were compared. The yield of ware was reduced in each case by increases in the size of riddle from 1⅝″ to 1¾″ and from 1¾″ to 2″.

The variety used in the trial was Majestic.

Three sizes of seed tubers were included and the largest size was also cut into halves and quarters.

Medium sized whole tubers, averaging 2½ oz. in weight, produced heavier yields of ware than any other setts of smaller or equal size, and this superiority was increased when the ware was dressed over larger riddles. Large seed produced similar yields of 1⅝″ and 1¾″ ware to medium seed but was inferior to medium seed when a 2″ riddle was used.

2½ oz. whole seed showed a higher net cash return per acre than any other grade, although where the smaller potatoes were given no commercial value, quartered seed was equally satisfactory.

The trial shows that the size of seed which has previously been shown to be most profitable in the case of other varieties, is also likely to be the best for Majestic and that this recommendation is unlikely to be affected by regulations affecting the size of riddle used.

Mention must here be made of experiments carried out by Bates in 1932, 1933 and 1934 in which the yields and proportions of ware produced by different sizes of seed were compared in relation to spacing.(4)

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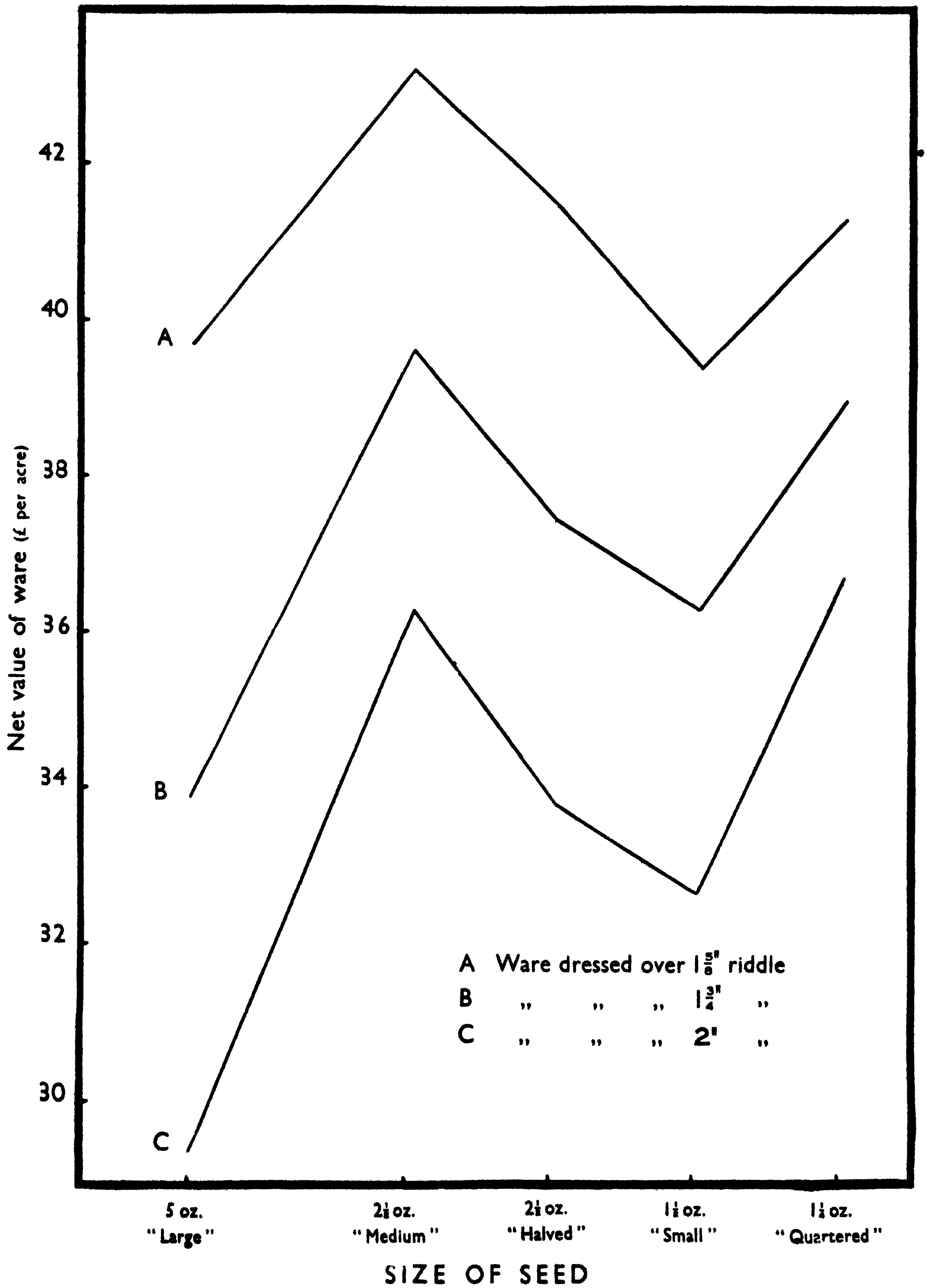
Figure 11


42
40
38
36
34
32
30
Net value of ware (£ per acre)
A
B
C
A Ware dressed over 1⅝" riddle
B " " " 1¾" "
C " " " 2" "
5 oz. "Large"
2½ oz. "Medium"
2½ oz. "Halved"
1¼ oz. "Small"
1¼ oz. "Quartered"
SIZE OF SEED

II. POTATO BOXING TRIAL, 1934.

A difficulty which is occasionally encountered in potato trials technique lies in the fact that the various stocks of seed to be grown in any particular trial may be received at different dates. It may happen that, while one lot of seed has been boxed for some months, the remainder can only be boxed for a period of weeks. Such variations are noted and allowance may be made for them in assessing the results of the trial; at the same time there is little information available as to the effect of differences in time of boxing. A trial was accordingly planned at Ormskirk to test the effect of various boxing periods on the resultant crop.

The variety chosen was Kerr's Pink, obtained from a plot grown at Ormskirk from Scotch stock seed in 1933. The seed for the trial was boxed in three batches, during October 1933, and on the 5th February and the 5th March 1934.

The trial consisted of eight blocks, within which a single row of each lot of seed was randomized. The rows were 28 inches apart and each contained fifty setts spaced at 16 inches.

Planting took place on the 16th April under good conditions. The previous crop was clover hay. The manures, which were applied to the potato drills at the time of planting, consisted of 16 - 18 tons of farmyard manure and 1 cwt. each of superphosphate, sulphate of ammonia and sulphate of potash per acre.

As the crop developed, a high proportion of virus infected plants was observed, but there were no other apparent differences between the growth of the different batches of seed. The proportions of virus infected plants were :—

October boxing	26 per cent.
February ,,	23 ,, ,,
March ,,	21 ,, ,,

The differences between the proportions of infected plants failed to reach statistical significance but were most consistent, following the same trend in every replication. It seems at least possible that the additional time of boxing favoured the development of virus symptoms.

The trial was lifted on the 18th October and the yields obtained are summarized in Table I.

Table I.

YIELD OF KERR'S PINK POTATOES WHEN BOXED FOR THREE DIFFERENT PERIODS.

Time of boxing.	Total yield Tons per acre	Yield of ware over 1⅝″ Tons per acre	Percentage of ware
October (6 months) ...	12·1	9·3	78
February (10 weeks) ...	12·6	10·4	83
March (6 weeks) ...	12·1	10·0	83
Significant difference ...	0·9	0·9	—

There were no significant differences between the total yields, but where the yield of ware was concerned the February boxed seed outyielded that boxed in October by 12 per cent., and this difference was statistically significant. The proportion of ware-sized tubers was somewhat higher in the crops produced from seed boxed for the shorter periods, but the differences were in any case small.

It would appear that an increase in the time of boxing from six to ten weeks had little effect on the size of crop, but that an increase to six months actually depressed the yield of ware. The amount of virus infection was greatest in the seed boxed for the longest period, and this may have been a cause of the higher proportion of small tubers in the crop.

III. VARIETY AND BOXING TRIAL, 1935.

During 1934 the variety Bintje was included in a trial at Cambridge and was found to give a similar yield to King Edward.(1)

It was decided to repeat the trial in 1935 and to use both Dutch and Lincolnshire-grown seed. The variety Doon Star was grown in the same trial. It had been entered in the Lord Derby Gold Medal trials in 1927, when it was thought to give indications of merit but received no award.(2) During the previous year the British acreage of Doon Star increased to 1949, and it was clearly desirable that a further test of the variety should be made.

A trial, which is reported above, was carried out at Ormskirk in 1934 to test the effect of boxing "once-grown" seed for different periods. The results were not conclusive, and it was hoped to combine a comparison of boxing periods with the trial under review. The seed was not, however, received in sufficient time to do more than make a comparison between seed boxed for five weeks and seed planted unboxed.

It was arranged that the produce should be dressed over a number of different sizes of riddle in order to provide further data as to the effect on the yield of ware of increasing the size of riddle.

The control varieties used were King Edward and Majestic, and the seed of these and of Doon Star was grown in Aberdeenshire.

METHOD OF TRIAL.

The trial consisted of eight blocks, each containing a plot of each of the five stocks. The plots were randomized within the blocks, and consisted of two 40-sett rows, one grown from boxed and the other from unboxed seed. Again, the seed "treatments" were randomized within the plots. The trial thus provided firstly a comparison between the five stocks of seed, and secondly a comparison between boxed and unboxed seed.

The whole of the seed had been received by the 14th March. Each stock was then divided into two parts, one of which was boxed and placed in an unheated greenhouse, while the other was bagged up and stored under the Institute's granary floor.

The Lincolnshire seed of Bintje was sound and even in size but very small, the tubers averaging 14 to the lb. Seed of the other stocks was more variable in size, and averaged between 6·3 and 6·9 per pound. It was realized that the great difference between the sizes of seed of the two stocks of Bintje would influence the relative yields, but it was felt that both should be grown.

The trial was arranged at Cambridge on a clay loam over gault, and continued wet weather during April delayed planting and made preparation of the land most difficult. The ridges were set up on the 23rd April and planting took place on the same day. There was little tilth and when the ridges were split after planting the land remained very rough. Farmyard manure

at the rate of 14 loads per acre was spread in the rows before planting and artificials were applied at the same time at the following rates :—

Superphosphate	4 cwt. per acre
Sulphate of potash	3 ,, ,, ,,
Sulphate of ammonia	3 ,, ,, ,,

When planted, the unboxed seed of both stocks of Bintje had numerous weak sprouts; the eyes of Majestic were just breaking; and there was no shoot development at all in King Edward or Doon Star. Of the boxed seed, Doon Star had strong sprouts, ⅛ inch to ¼ inch long, while the other varieties had ¼ inch to ½ inch sprouts.

GROWTH.

With the exception of Doon Star, the plots grown from boxed seed appeared shortly after the mid-May frosts; Doon Star appeared on the 3rd June, when the unboxed rows* of all varieties began to show through. The Lincolnshire Bintje was somewhat later in appearing than the Dutch stock, both boxed and unboxed.

The difference between the boxed and unboxed plots lay not only in their times of emergence, but also in the very much more even appearance of the former. These differences were still apparent on the 27th June, but on the 8th July it was hardly possible to distinguish between the two rows of each plot. During July growth was vigorous and the trial seemed more forward than neighbouring crops which had been checked by frost. The number of "misses" was counted and found to be small and similar in the different varieties, both boxed and unboxed.

By mid-August the continuance of the drought, following the exceptionally dry seasons of 1933 and 1934, had resulted in a definite stunting of the crop. This was particularly marked in Doon Star and there was considerable doubt as to whether the condition was not in part at least pathological. It was clear that Doon Star had less power of resistance to drought than the other varieties. In addition, many of the plants showed the more obvious symptoms of leaf-roll. The leaflets curled upwards from the edges, the underside of which showed a purple colouration. There was however none of the harshness characteristic of leaf-roll. The leaflet became paler and died back from the edge and in many cases the whole leaf withered. It was common for one stem of a plant to be affected while the others remained apparently healthy. These plants tended to occur in groups, there being some rows with 30 per cent. of affected plants and others with none. The boxed rows contained a very much higher proportion of these plants than the unboxed rows. The plots of Bintje showed similar symptoms, though to a lesser extent, and they were very evident in the plants of Arran Victory which were used as a surround for the trial.

On incubation, material from affected leaves of Doon Star showed abundant presence of Alternaria solani.

* Rows grown from boxed and unboxed seed are referred to as "boxed" and "unboxed" rows respectively.

The proportions of affected plants were as follows :—

	Boxed per cent.	Unboxed per cent.
King Edward ...	0	0
Majestic ...	0	0
Doon Star ...	17	2
Bintje (Dutch) ...	2	1
Bintje (Lincs.) ...	0	3

The extent of secondary Y-virus symptoms was slight, amounting to two plants of Majestic and one of Doon Star, but the Lincolnshire seed of Bintje was more heavily infected, showing 2 per cent. in the boxed and 4 per cent. in the unboxed rows. During July the extensive appearance of " leaf-drop streak " gave evidence of primary infections of the Y-virus, the proportions of plants affected being as follows :—

	Boxed per cent.	Unboxed per cent.
King Edward ...	10	13
Majestic ...	6	6
Doon Star ...	21	8
Bintje (Dutch) ...	27	15
Bintje (Lincs.) ...	23	23

Leaf-roll made its appearance in July, Majestic being heavily infected. Owing to other abnormal conditions, the amount of leaf-roll in Doon Star and Bintje could not be estimated. None was observed in King Edward.

MATURITY.

All stocks showed signs of ripening in mid-August, but the late August rains brought a check and it was not until the 25th September that the tops of Bintje (both stocks) were recorded as dead. On the 7th October 50 per cent. of the plots of Doon Star were still green, while King Edward and Majestic showed little sign of ripening.

The plots were lifted on the 7th, 8th and 11th October, since the heavy soil and continued rain would have made later lifting difficult. Second growth was general in King Edward and Bintje, but was absent in Majestic and Doon Star. It was observed that both Doon Star and Bintje lifted cleanly in spite of wet weather at the time.

YIELD.

The produce of each row was dressed over four sieves. In the case of King Edward and Bintje, over $1\frac{1}{2}''$, $1\frac{5}{8}''$, $1\frac{3}{4}''$ and $1\frac{7}{8}''$ riddles, and over $1\frac{5}{8}''$, $1\frac{3}{4}''$, $1\frac{7}{8}''$ and $2''$ for Majestic and Doon Star.

The total yields and yields of ware (over $1\frac{5}{8}''$) of the different varieties from boxed and unboxed seed are given in Table I. Tables II and III summarize the varietal and treatment yields.

Both in total yield and in yield of ware Majestic significantly outyielded all other stocks. The yield of Bintje (Dutch) and King Edward were similar, although King Edward produced a higher proportion of ware; both outyielded Doon Star and the Lincolnshire stock of Bintje, which had similar yields.

The yield from boxed seed was slightly higher than that from unboxed seed, but the difference was not significant. In every variety except Doon Star, boxed seed gave a slightly higher yield, but again the differences lacked significance. The greater yield from unboxed seed of Doon Star may have been due to the larger number of abnormal plants in the boxed plots. In every variety, boxed seed gave a smaller proportion of ware-sized tubers than unboxed seed.

QUALITY.

Second growth was prevalent in King Edward and was present to some extent in Bintje. The former were not a good sample, a large proportion of tubers being immature. The tubers of Bintje appeared sound on lifting, but within three weeks 15 per cent. to 20 per cent. had become rotten. Although this may have been due in part to the crop having been left in the ground for some weeks after maturity, it should be mentioned that the crop of Bintje grown in the 1934 trial at Cambridge also kept poorly, very few tubers remaining sound after Christmas.

The sample of Majestic was sound and typical of the variety. The tubers of Doon Star were small, but lifted cleanly and had a most attractive appearance. The shape was generally round.

Comparative cooking tests of the varieties were not carried out, owing to the poor condition of the King Edwards. Samples of Doon Star were cooked, however, and it was agreed that the variety had excellent cooking qualities both for boiling and frying.

EFFECT OF INCREASE IN SIZE OF RIDDLE.

Changes in size of riddle had much the same effect on the yields from boxed and unboxed seed, and the latter have therefore been bulked. Tables IV and V show the yields obtained when various riddles were used and the percentage reduction in yield due to each increase in mesh.

An increase in the size of riddle from $1\frac{5}{8}''$ to $1\frac{3}{4}''$ reduced the ware yield of both King Edward and Majestic by 12 per cent. The change from $1\frac{3}{4}''$ to $1\frac{7}{8}''$ had very little effect on the yield of any variety, in spite of the fact that the varietal yields and proportions of ware varied greatly. When the size of riddle was raised to 2″, as in Majestic and Doon Star, the yield was further reduced by 8 per cent. and 17 per cent. respectively.

SUMMARY.

The varieties King Edward, Majestic and Doon Star grown from Scotch seed and stocks of Bintje grown in Holland and Lincolnshire were compared in a yield trial at Cambridge. A further comparison was made between seed of each boxed for five weeks and seed planted unboxed.

Majestic produced the greatest yield, followed by King Edward and the Dutch stock of Bintje. The latter outyielded the Lincolnshire grown stock, but this difference was probably due in part to the larger size of the Dutch seed. The yield of Doon Star was poor.

The yields from boxed and unboxed seed were similar. 3 per cent. of all plants from the Lincolnshire stock of Bintje showed secondary symptoms of Y-virus infection. None was present in the Dutch stock.

Many of the plants of Doon Star presented an abnormal appearance, the cause of which has not been ascertained. The cooking quality was good.

Table I.

Variety		Yield (tons per acre) Total	Ware (over 1⅝″)	Percentage ware
King Edward	Boxed	13·7	10·6	77
,, ,,	Unboxed	12·1	9·7	80
Majestic	Boxed	14·0	12·5	89
,,	Unboxed	13·6	12·2	90
Doon Star	Boxed	10·3	8·1	79
,, ,,	Unboxed	11·1	9·2	83
Bintje (Dutch seed)	Boxed	13·2	9·7	73
,, ,, ,,	Unboxed	12·6	9·4	75
Bintje (Lincolnshire seed)	Boxed	11·2	8·2	73
,, ,, ,,	Unboxed	10·5	8·0	76

Significance of results. The values of z are not significant in the 5% table. (The differences are not significant).

Table II.

VARIETIES (BOXED AND UNBOXED SEED).

Variety	Yield (tons per acre) Total	Ware (over 1⅝″)	Percentage ware
King Edward	12·9	10·2	79
Majestic	13·8	12·4	90
Doon Star	10·7	8·7	81
Bintje (Dutch seed) ...	12·9	9·6	74
,, (Lincolnshire seed)...	10·9	8·1	74

Significance of results.

1. *Total yield.* The value of z is significant in the 1% table.
   A difference of 0·8 tons per acre is significant.

2. *Yield of ware.* The value of z is significant in the 1% table.
   A difference of 0·7 tons per acre is significant.

Table III.

BOXED V. UNBOXED SEED (ALL VARIETIES).

Seed	Yield (tons per acre)		Percentage ware
	Total	Ware (over 1⅝")	
Boxed ...	12·5	9·8	78
Unboxed ...	12·0	9·7	81

Significance of results. The values of z are not significant in the 5% table. (The differences are not significant).

Table IV.

YIELDS OF VARIOUS GRADES OF WARE.

Tons per acre.

Variety	Total	Over 1½"	Over 1⅝"	Over 1¾"	Over 1⅞"	Over 2"
King Edward ...	12·9	10·7	10·2	9·0	8·8	—
Majestic ...	13·8	—	12·4	11·0	10·8	10·0
Doon Star ...	10·7	—	8·7	7·0	6·7	5·6
Bintje (Dutch) ...	12·9	10·2	9·6	8·0	7·7	—
,, (Lincs.) ...	10·9	8·8	8·1	7·1	6·8	—

Table V.

EFFECT OF SUCCESSIVE INCREASES IN SIZE OF RIDDLE.

(Reduction in yield expressed as a percentage of the yield when dressed over the next smaller riddle).

Variety	1½" to 1⅝" per cent.	1⅝" to 1¾" per cent.	1¾" to 1⅞" per cent.	1⅞" to 2" per cent.
King Edward ...	6	12	3	—
Majestic ...	—	12	2	8
Doon Star ...	—	19	5	17
Bintje (Dutch) ...	7	16	4	—
,, (Lincs.) ...	8	13	4	—

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OFFICIAL SEED TESTING STATION
FOR
ENGLAND AND WALES.

SEVENTEENTH ANNUAL REPORT, 1933-34.

ALFRED EASTHAM, D.S.O., M.C., B.Sc.

The present report covers the period from August, 1933 to July, 1934, during which 27,077 samples were submitted to the Station for analysis. Although this figure is 2·7% less than that for the season 1932-33 yet it exceeds the average of the fifteen previous seasons by 2,919. Apart from the 27,077 samples recorded above, a further 2,410 tests of an investigational character were made, thus bringing the total of samples tested during the season up to 29,487.

The number of seed firms and farmers who submitted samples for analysis during the season under review is shown in table I, together with the actual number of samples from these sources. Figures for the two preceding seasons are included for comparative purposes. The figure representing the number of samples received from farmers includes only those samples tested for farmers and growers at the special reduced fee, i.e., where the results of the tests were required for seeding and not for sale purposes. In cases where the results of the tests on farmers' samples were for sale purposes, to enable the senders to comply with the provisions of the Seeds Act 1920, the full fees were charged and the number of such samples has been included in the figure representing the number of samples from seed firms. Samples from public departments include control samples and reserve portions from private licensed stations taken by inspectors of the Ministry of Agriculture in connection with the administration of the Seeds Act.

The number of seed firms sending samples is the lowest since 1923-24 and the number of samples from this source shows a decrease of 5·8% compared with the immediately preceding season. The average number of samples per firm, however, remains relatively high, i.e. 13·04. Although the number of farmers using the Station shows a relatively large decrease, yet the number of samples from farmers still stands at a high level, compared with previous seasons. The number of samples from public departments is higher than in any season since 1928-29.

Table I.

			1933-34	1932-33	1931-32
Seed firms	Number sending samples	...	**1592**	1650	1823
	" of samples received	...	**20765**	22055	21032
Farmers etc.	" sending samples	...	**922**	1032	1281
	" of samples received	...	**2291**	2341	2737
Public depts.	" of samples received	...	**4021**	3443	3930
Total number of samples		...	**27077**	27839	27699

The distribution according to species, of the samples received, is shown in table II, together with comparable figures for the two preceding seasons. The total fall in numbers of the cereal and pulse groups is approximately twice the increase shown by the combined vegetable, clover and grass groups. In the cereal group it will be seen that the relatively large fall in the numbers is due chiefly to oat and wheat samples — in the case of oats the figure recorded is the lowest since 1920-21. Generally speaking the quality of oat samples in the season under review was appreciably better than in any preceding season, relatively few parcels of a difficult nature being encountered. This is no doubt partly responsible for the large falling off in the number of oat samples, as it is usually the Station's experience that a harvest producing good quality seed results in fewer samples being received and vice-versa. A decrease of 25·9% compared with the previous season, in the case of peas, accounts chiefly for the total fall in numbers in the pulse group. The total number of samples shown in the vegetable and root seed group is only slightly greater than in the previous season, but considerable relative increases are shown in the case of turnip, swede, kale, cabbage and broccoli and cauliflower, with decreases of some magnitude in the case of mangold, beet, onion and "other vegetables".

In the clover group a total increase is shown, due chiefly to red clover and white clover respectively. An increase in numbers is recorded for each of the species listed in the grass group, and in the case of cocksfoot, crested dogstail and " other grasses " the figures are higher than in any previous season. There has been a remarkable increase over the last ten years in the number of samples here described as " other grasses ". During the season 1923-24 the number of such samples reached only 189, since when there has been a considerable increase each succeeding year. Confidence in the Station's ability to analyse such difficult species, combined with an increased interest in most of these species on the part of golf clubs, sports clubs, etc., has played no small part in bringing about such phenomenal increases in the number of samples received each year.

Table II.

NUMBER OF SAMPLES OF DIFFERENT KINDS OF SEEDS TESTED.

Cereals	1933-34	1932-33	1931-32
Wheat	**4465**	4575	2741
Barley	**1611**	1543	2651
Oats	**3818**	4771	5747
Rye	**126**	131	145
Maize	**36**	47	33
	10056	11067	11317

Table II continued.

	1933-34	1932-33	1931-32
Pulses			
Peas	**1514**	2045	1921
Beans	**345**	367	415
Vetches	**382**	407	352
	2241	2819	2688
Roots and Vegetables			
Turnip	**526**	472	371
Swede	**687**	613	557
Rape	**81**	88	84
Kale	**390**	297	234
Cabbage	**509**	402	471
Brussels Sprout	**88**	74	103
Broccoli and Cauliflower	**314**	297	179
Other Crucifers	**126**	133	221
Mangold	**903**	988	945
Beet	**777**	819	929
Onion	**411**	458	544
Parsnip	**136**	110	143
Carrot	**262**	259	272
Other Vegetables	**249**	369	254
	5459	5379	5307
Clovers			
Red Clover	**2831**	2645	2650
Alsike	**281**	324	287
White Clover	**1317**	1166	1205
Trefoil	**377**	461	540
Lucerne	**111**	109	85
Sainfoin	**280**	249	436
Crimson Clover	**65**	79	84
Other legumes	**60**	44	41
	5322	5077	5328
Grasses			
Perennial Ryegrass	**944**	840	817
Italian Ryegrass	**555**	514	510
Cocksfoot	**420**	374	329
Timothy	**211**	209	207
Meadow Fescue	**127**	110	70
Crested Dogstail	**218**	200	186
Other Grasses	**1053**	877	535
Mixtures	**344**	284	316
	3872	3408	2970
Linseed	**13**	15	23
Forest Trees	**86**	49	43
Miscellaneous	**28**	25	23
	127	89	89

The distribution of samples per month during the season is shown in table III, together with corresponding figures for 1932-33. As in previous years, the peak months are shown to be October, February and March, and it is of interest to note that during the latter months the average number of samples received per working day reached 170.

Table III.

NUMBER OF SAMPLES RECEIVED PER MONTH.

Season		Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
1933-34	...	**1313**	**2765**	**3572**	**2377**	**2025**	**3310**
1932-33	...	814	2528	3878	2385	1916	2921

Season		Feb.	March	April	May	June	July
1933-34	...	**4262**	**4349**	**1791**	**618**	**286**	**409**
1932-33	...	4298	5650	2155	760	323	211

Purity and Germination.

In the tables IV, V, VI and VII, the average germination figures for the season of the different species tested are shown and in tables VI and VII average purity figures are also given. For comparative purposes figures representing the total averages of previous seasons are included. As a further indication of general quality, the percentage number of samples germinating below the minimum percentage of germination provided in the Seeds Regulations 1922 is given for the seeds for which such a standard has been prescribed. In the case of grasses and clovers the tables also include figures showing the percentage number of samples containing one per cent. or more of " injurious weed seeds ".

In most seasons the Station receives many samples of root and vegetable seeds from " carried over " stocks and such samples are not infrequently of low germination. Consequently the figures in table V do not necessarily reflect accurately the quality of the majority of commercial bulks of root and vegetable seeds handled in this country.

The figures shown in the following tables need little amplification. Generally speaking it may be said that the quality of all seeds was, if anything, above the average. Wheat, oats, runner beans, rape, mangold, parsnip, radish, Poa trivialis, tall fescue and Chewing's fescue all show average germination figures higher than any recorded for a number of years; in fact, in most of these cases the figures are higher than any previously recorded. In only one or two instances are the average figures lower than in any previous season. One outstanding feature brought out in these tables is the relatively high average percentage of " hard seeds " in most of the clover species. In most cases the average percentage of " hard seeds " is higher than in any previous season. The seed concerned would have been harvested chiefly from the 1933 crop, a year when a phenomenally hot, dry summer was experienced.

Table IV.

PERCENTAGE GERMINATION OF CEREALS.

			No. of samples included in the averages	Average germination per cent.		Percentage of samples below authorised minimum	
				1933-34	1917-33	**1933-34**	1932-33
Wheat	...	...	4120	**97·4**	95·6	**1·8**	6·4
Barley	...	...	1535	**95·9**	95·0	**8·3**	8·1
Oats	...	...	3607	**95·8**	93·4	**3·1**	4·0
Rye	...	...	110	**88·6**	90·4	**11·8**	11·8

Table V.

PERCENTAGE GERMINATION OF PULSES AND ROOT AND VEGETABLE CROPS.

	No. of samples included in averages	Percentage of germination 1933-34	Percentage of germination 1917-33	Percentage of samples germinating below authorised minimum (authorised minimum in brackets)
Peas (Field and Garden) ..	1318	**93·6**	87·6	3·3 (80F., 70G.)
Beans (Field)	128	**95·0**	95·3	3·9 (90)
Beans (Broad)	66	**95·0**	93·4	1·5 (75)
Beans (Runner)	57	**90·3**	79·9	3·5 (60)
Beans (Dwarf)	59	**77·5**	84·6	35·6 (75)
Vetches	350	**83·8**	89·6	31·1 (90)
Turnip (Field and Garden)..	441	**82·7**	86·4	27·9 (80)
Swede	558	**85·2**	84·0	18·8 (80)
Rape	71	**92·4**	87·7	7·1 (80)
Kale	369	**81·2**	80·2	15·4 (70)
Cabbage	404	**82·3**	79·5	15·0 (70)
Brussels Sprout	63	**85·1**	79·9	4·8 (70)
Broccoli and Cauliflower ...	238	**77·2**	75·7	13·0 (60)
Kohl Rabi . ..	19	**71·3**	75·4	5·2 (70)
Mangold . ..	748	**80·3**	75·5	6·4 (60)
Beet (Garden)	121	**76·1**	71·8	5·8 (50)
Beet (Sugar) . .	419	**85·2**	82·3	·9 (60)
Parsnip . ..	57	**78·2**	64·1	8·8 (45)
Carrot	159	**61·0**	64·8	12·1 (50)
Onion	270	**68·6**	66·7	24·4 (60)

Other seeds.

		1933-34	1932-33
Mustard .	34	**89·5**	84·2
Lettuce .. .	65	**86·5**	79·6
Radish	41	**87·0**	83·9
Celery	62	**67·9**	70·7
Parsley	23	**63·7**	56·5
Spinach . .	17	**82·6**	65·4
Flax . ..	13	**93·7**	76·3

Table VI.

PERCENTAGE PURITY AND GERMINATION OF GRASSES.

	No. of samples included in the averages	Average percentage of impurities 1933-34	Average percentage of impurities 1922-33	Percentage of samples containing 1 per cent. or over of injurious weed seeds 1933-34	Percentage of samples containing 1 per cent. or over of injurious weed seeds 1932-33	Average percentage of germination 1933-34	Average percentage of germination 1922-33
Perennial Ryegrass ..	744	**3·43**	2·82	**14·7**	11·0	**82·5**	82·3
Italian Ryegrass	459	**2·92**	2·75	**19·3**	13·4	**81·5**	82·7
Cocksfoot	275	**8·21**	10·05	**nil.**	1·2	**86·7**	89·8
Timothy .. .	151	**1·80**	1·16	**2·7**	1·4	**91·1**	88·6
Meadow Fescue	87	**2·40**	2·37	**3·5**	3·7	**85·3**	82·7
Dogstail	183	**4·46**	3·15	**5·5**	5·3	**86·0**	82·3

Other grasses not scheduled in the Seeds Regulations.

		1933-34	1932-33	1933-34	1932-33
Hard Fescue	99	**7·8**	6·6	**82·3**	80·4
Tall Oat Grass ...	9	**7·6**	6·1	**91·2**	81·2
Agrostis spp.	137	**6·0**	5·6	**89·4**	89·9
Meadow Foxtail	19	**34·3**	34·7	**67·6**	64·0
Poa trivialis	79	**8·3**	6·8	**87·1**	85·1
Poa pratensis	40	**13·5**	9·9	**82·0**	82·9
Poa nemoralis	17	**18·8**	16·7	**74·2**	65·4
Chewing's Fescue ...	144	**1·1**	1·4	**87·3**	60·9
Sheep's Fescue	27	**13·1**	17·8	**70·9**	62·3
Tall Fescue	16	**4·8**	5·3	**80·7**	78·2
Red Fescue	37	**6·6**	5·4	**84·2**	73·8

Table VII.

PERCENTAGE PURITY AND GERMINATION OF CLOVERS.

	No. of Samples in averages	Average percentage of impurities		Percentage of samples with 1 per cent. or over of injurious weed seeds		Average percentage of germination		Average percentage of hard seeds	
		1933-34	1917-33	**1933-34**	1932-33	**1933-34**	1917-33	**1933-34**	1917-33
Red Clover (all samples) ...	2269	**3·10**	3·54	**3·5**	5·7	**79·1**	78·4	**7·1**	4·4
„ „ (English) ...	809	**3·41**	3·20	**1·9**	5·2	**80·3**	78·2	**8·1**	4·8
„ „ (French) ...	2	**4·00**	4·20	**nil.**	nil.	**72·0**	89·1	**2·0**	3·3
„ „ (Chilean) ...	70	**3·90**	1·77	**nil.**	nil.	**85·9**	88·6	**6·6**	5·7
„ „ (American) ...	25	**1·28**	1·61	**nil.**	nil.	**92·7**	90·1	**4·9**	5·3
„ „ (New Zealand)	8	**1·90**	1·83	**nil.**	nil.	**92·8**	89·1	**1·9**	4·8
Alsike (all samples) ...	232	**4·64**	4·35	**·8**	·4	**82·0**	83·0	**6·2**	6·2
White Clover (all samples)	1237	**5·28**	7·30	**6·2**	8·5	**78·3**	77·2	**14·9**	10·0
„ „ (English) ...	31	**2·36**	5·38	**19·4**	30·4	**84·6**	81·2	**8·8**	7·1
„ „ (Mid-European)	108	**4·08**	5·20	**6·5**	8·9	**87·6**	83·5	**5·2**	6·5
„ „ (New Zealand)	2	**3·75**	3·58	**nil.**	nil.	**88·0**	87·1	**nil.**	7·5
Wild White Clover ...	809	**5·20**	8·52	**3·8**	4·5	**76·7**	74·2	**16·9**	12·6
Trefoil	277	**1·26**	1·50	**·3**	·9	**77·4**	75·1	**4·5**	2·5
Lucerne	98	**2·28**	2·45	**nil.**	nil.	**71.1**	82·1	**6·3**	5·4
Sainfoin	248	**1·97**	3·33	**nil.**	nil.	**83·5**	70·5	**3·1**	·2
Crimson Clover	47	**2·61**	3·13	**4·2**	nil.	**78·0**	80·4	**1·1**	·3

Dodder in clover samples.

In the following table the percentage of samples found to contain seeds of clover dodder, in the season under review, is given for each of the species examined, together with corresponding data for each of the preceding seasons. A gradual increase over the past four years is noticeable in the percentage of red clover samples found to contain dodder.

Table VIII.

PERCENTAGE OF SAMPLES CONTAINING DODDER.

Red Clover.

	All samples	English	French	Czecho-Slovak	Chilean	U.S.A.	New Zealand
1933-34 ...	**6·2**	**1·6**	**nil.**	—	**95·7**	**8·0**	**nil.**
1932-33 ...	5·5	·5	3·8	—	89·2	14·2	nil.
1931-32 ...	3·6	·8	·1	—	92·0	8·3	nil.
1930-31 ...	2·8	1·7	12·9	—	91·6	nil.	nil.
1929-30 ...	4·0	1·5	nil.	—	80·0	33·3	nil.
1928-29 ...	4·9	2·2	14·2	—	85·0	nil.	14·3
1927-28 ...	8·5	3·4	13·9	—	86·6	nil.	nil.
1926-27 ...	6·5	3·6	7·3	—	89·6	nil.	nil.
1925-26 ...	7·2	3·2	9·7	nil.	89·1	nil.	25·0
1924-25 ...	10·1	5·3	8·3	nil.	94·5	11·1	20·0
1923-24 ...	10·5	5·9	8·0	nil.	98·5	·6	1·4
1922-23 ...	29·4	17·6	8·8	43·7	91·7	18·0	23·5
1921-22 ...	21·8	10·2	18·2	57·1	83·6	nil.	nil.
1920-21 ...	19·2	4·4	13·4	83·7	82·6	30·0	10·0
1919-20 ...	18·9	3·4	15·4	75·5	81·1	10·1	nil.
1918-19 ...	27·3	12·1	36·6	—	90·9	10·1	—

	Alsike All samples	*Alsike* Mid-European	*White Clover* All samples	*White Clover* Mid-European	*White Clover* New Zealand	*Alsike and White*	*Lucerne*
1933-34 .	nil.	—	nil.	**nil.**	**nil.**	**1·0**	**5·1**
1932-33 ...	**nil.**	—	**nil.**	nil.	nil.	1·3	6·7
1931-32 ...	nil.	—	·1	nil.	nil.	2·4	9·4
1930-31 ...	·5	—	1·3	5·1	nil.	5·9	8·6
1929-30 ..	·6	—	·6	4·4	nil.	9·7	8·7
1928-29 ...	1·6	—	·1	6·1	—	·7	9·4
1927-28 ...	nil.	—	·1	5·6	nil.	—	5·9
1926-27 ..	nil.	nil.	·4	2·1	7·1	5·8	5·7
1925-26 ...	nil.	nil.	1·5	nil.	12·5	nil.	11·3
1924-25 ...	1·3	—	5·6	12·9	37·5	2·9	12·5
1923-24 ...	1·0	nil.	2·4	nil.	66·6	2·0	11·1
1922-23 ...	4·1	21.1	17·6	5·0	48·3	22·2	11·5
1921-22 ...	6·4	20·0	4·5	3·5	25·0	7·9	7·3
1920-21 ...	5·5	38·9	3·4	12·5	9·4	16·1	12·3
1919-20 ...	6·1	44·4	3·1	11·1	—	13·6	12·2
1918-19	less than 1·0	—	1·3	—		less than 1·0	6·7

Varieties of cereals.

The distribution of cereal samples, according to variety, is shown in table IX. Although these figures are not necessarily representative of the areas sown, yet they give an indication of the relative popularity of different varieties. Samples are sometimes received at the Station bearing no variety name, so that two sets of figures are shown for each variety in the table — one set gives the percentage occurrence amongst all samples and the other the percentage amongst named varieties only. Only those varieties are included which are present to an extent of at least 0·9% of all samples. There is no significant change in the first few varieties in any group, when compared with the past three or four years.

Table IX.

DISTRIBUTION OF CEREAL SAMPLES ACCORDING TO VARIETY.

A.—WHEAT.

	Percentage of total	Percentage of named varieties		Percentage of total	Percentage of named varieties
Red Standard	12·0	14·4	April Bearded	1·5	1·8
White Victor .	11·7	14·1	Million III .. .	1·4	1·7
Little Joss ..	11·6	13·9	Chevalier	1·4	1·7
Squarehead's Master .	9·7	11·7	Rivett	1·3	1·6
Yeoman .. .	6·0	7·3	Garton's 60 .. .	1·0	1·2
Wilhelmina . .	5·8	6·9	Squarehead Success .	1·0	1·2
Red Marvel	3·1	3·8	Benefactor	·9	1·1
Renown .. .	2·4	2·8	Other named varieties.	10·4	12·4
Squarehead's Master II	2·0	2·4	Not named	16·8	

B.—BARLEY.

	Percentage of total	Percentage of named varieties		Percentage of total	Percentage of named varieties
Spratt Archer	14·7	27·1	Standwell	1·7	3·2
Plumage Archer ...	12·3	22·7	Chevallier	1·6	3·0
Plumage	7·3	13·6	Pembroke	1·3	2·4
New Cross	4·4	8·1	Goldthorpe	1·1	2·0
Golden Archer	2·1	3·8	Other named varieties ...	5·8	10·7
Archer	1·9	3·4	Not named	45·8	

C.—OATS.

	Percentage of total	Percentage of named varieties		Percentage of total	Percentage of named varieties
Victory	17·0	19·4	Black	2·0	2·3
Abundance . .	8·3	9·5	White Superb	1·8	2·1
Black Tartar	5·5	6·4	Black Sprig	1·6	1·9
White Winter	5·3	6·1	Star	1·5	1·8
Marvellous	5·3	6·1	Prolific	1·4	1·5
Black Supreme .	5·3	6·1	Castleton Potato ...	1·3	1·4
Black Winter . .	5·2	6·0	Progress	1·0	1·1
White	5·1	5·8	Potato . . .	1·0	1·1
Grey Winter . .	4·9	5·6	Unique	·9	1·0
Yielder	2·9	3·3	Other named varieties...	7·5	8·5
Golden Rain	2·6	3·0	Not named	12·6	

Seed-borne diseases.

A. DISEASES OF CEREALS.

Naked eye examination for the presence of certain seed-borne diseases has been made of all cereal samples concerned. Figures showing the percentage of samples with " naked-eye " evidence of infection are given in table X below, together with comparable figures for the previous season. The cereal samples so examined would have been derived almost entirely from the harvest of 1933. The figures for earcockle in wheat and ergot in barley and in rye show little change compared with the previous season. The percentage of wheat samples containing bunted grains or " bunt balls " is lower than in any previous season. Smutted grain in barley, however, shows a slight upward trend, whilst ergot in wheat is lower than in the two previous seasons. In the case of ergot in wheat, barley and rye, the actual amount of ergot present per infected sample was small and in the majority of cases was by weight only a " trace ".

Table X

	1933-34 Per cent.	1932-33 Per cent.
Bunt in Wheat ...	**3·9**	5·1
Earcockles in Wheat ...	**2·5**	2·5
Ergot in Wheat .	**1·2**	2·4
Smut in Barley . .	**3·7**	1·6
Ergot in Barley ...	**1·0**	1·0
Ergot in Rye ...	**10·9**	10·9

B. DISEASES OF CELERY.

42 samples of celery seed were submitted during the season for special examination for the presence of Septoria Apii. Chester (celery leaf spot) and these samples were also examined for Phoma apiicola. Kleb (Phoma root rot). Tables are given below showing the number and percentage of samples falling within certain ranges of infection.

Celery Leaf Spot.

Range of Infection per cent.	No. of Samples.	No. of samples as percentage.
Nil.	6	14·3
1-5	5	11·9
6-10	6	14·3
11-20	5	11·9
21-30	4	9·5
31-40	4	9·5
41-50	3	7·1
51-60	4	9·5
61-70	1	2·4
71-80	2	4·8
81-90	2	4·8

Phoma Root Rot.

Nil.	20	47·6
1-5	20	47·6
6-10	2	4·8

Moisture content of seed samples.

219 samples were submitted for moisture content determination during the season. This number was made up as follows :—

Wheat	118	samples.
Barley	1	,,
Oats	1	,,
Swede	1	,,
Sugar beet	38	,,
Chewing's fescue ...	60	,,

Wild White Clover Certification Scheme.

During the season 1933-34, the fourth year of the Scheme's operation, the number of samples of seed-heads collected from inspected pastures and received at the Station for the purpose of the " growing-on " test, again reached only 50. The seed from these samples was rubbed out and scarified and sown in September, 1933. The resulting plots were examined and reported upon in the early summer of 1934 by the " Growing-on " Committee set up under the Scheme. The number of plots sown from " seed-head " samples collected during the first four years of the Scheme reached a total of 838.

Referee samples.

The 11th series of referee samples was sent out during the season to be tested at the Stations of all seed firms licensed to test the seeds in question. The results were tabulated and copies of the completed figures, together with explanatory notes, were subsequently sent to the firms concerned by the Ministry of Agriculture in Seed Analysts' Bulletin No. 24.

Investigations.

In addition to the 27,077 samples for analysis approximately 2,410 tests were made in connection with various investigations carried out during the year.

Acknowledgment.

Much help in the preparation of this report has been given by Mr. C. C. Brett, to whom grateful acknowledgment is made.

MEETINGS OF THE FELLOWS OF THE INSTITUTE.

FOURTEENTH ANNUAL GENERAL MEETING.

The Fourteenth Annual General Meeting of Fellows of the Institute was held at Cambridge on the 18th July, 1935. Mr. W. Gavin, Chairman of the Council, who presided, submitted the Fifteenth Annual Report of the Council and the accounts for the year 1933-34, and it was unanimously agreed that they be received. An address was then given by the Chairman on the National Institute of Agricultural Botany and the Seed Trade. This is printed below. The rest of the meeting was occupied by the inspection of the exhibits in the Official Seed Testing Station and the work in progress on the Headquarters Trial Ground.

THE INSTITUTE AND THE SEED TRADE.

Before beginning my address I should like personally to refer to the retirement, under Doctor's orders, of Mr. William Hasler from the Council of the Institute. No one is more respected and no one has done more for the Institute since its foundation than Mr. Hasler. I am sure all of us here receive this news with greatest regret and send him our very best wishes.

This is the time when many of us — both individuals and institutions — have been looking back into the past in company with our King and Queen, who have themselves shown their interest in our work by a personal visit, and comparing the circumstances as they exist to-day with those ruling 25 years ago. Now although the N.I.A.B. cannot yet claim its own Jubilee, it may be opportune to set side by side the position as we find it to-day and the hopes and thoughts that were in our minds at the birth of the Institute. Is the child growing up into a healthy citizen, likely to bear its allotted task in the Nation's work, or is it suffering from any of those strange deficiency diseases in which all of us to-day are so deeply interested?

I have been reading the speeches of my distinguished predecessors in the chair, and I cannot attempt such masterly reviews as they have given, but perhaps I can be excused if for a few moments I guide your thoughts away from the routine of the Institute in which we are all concerned and in which some of you spend your working hours — to consider the underlying principles of all our efforts — are we fulfilling them, and are we fulfilling them fast enough?

In all enterprises it is so easy to quieten ourselves with the thought that we shall get there in the long run. Now as Mr. J. M. Keynes has profoundly remarked, " In the long run we shall all be dead ". I am forced to the conclusion that we must do something more to secure the full support of the seed

trade, and that therein lies our deficiency. We certainly are not going to die and I am confident that in the long run full co-operation will prevail. But we must face facts. The National Association of Corn and Agricultural Merchants and the Agricultural Seed Trade Association together have some 2,000 members, half of whom are directly concerned. Yet less than 10% are fellows of this Institute. Our motto, " Better seeds — Better crops " could equally well be borne on the shield of the seed trade. Is there anything we can do to hasten the day of this full co-operative advance? We were founded and are working with the co-operation of the trade. Much has already been done. The work on potato synonyms is well known, and a promising start has already been made with cereals. Are they receptive of the help we can give them in return?

It may be that I am rushing in where members of the trade themselves would fear to tread, but as a detached outsider it does seem to me that there are three points worth discussing.

Firstly although full and free competition is useful and commendable, it does appear to me — once again as a detached observer — that there is far too much anxious competition to gather in one another's business rather than co-operative effort to obtain new business, i.e. to persuade additional customers that better seeds really do mean better crops. This cut-throat competition is, of course, a constant feature of most other trades until its members really get together.

Perhaps we feel that we could all live happily ever after if there were only two people in our trade — if our ideals or our long views were not undermined by others anxious to scratch a hasty profit to our detriment. But patience and forbearance, above all backed by personal contacts, can in time win the day. I do not think the seed trade is now in the position indicated many years ago in a quotation I read the other day from Adam Smith, who said, " People of the same trade seldom meet together even for merriment and diversion, but the conversation ends in a conspiracy against the public or in some contrivance to raise prices ".

Next, can we persuade the breeders and selectors to bring their new varieties to us for widespread trial at an early stage — after a preliminary chequer-board trial? Too often they multiply a promising novelty for 3 or 4 years and it is only then that they find it is disappointing.

Lastly, and this point is closely connected with the one just mentioned, I feel there is too much fear among the trade of interference and control. Most seed growers and merchants have spent their life in their trade and often their fathers before them. They will continue, they say, to run their business on their own lines.

But are any of us to-day really running our businesses on our own lines? Wages are controlled by the State and Trade Unions, production is becoming increasingly regulated by national and international arrangements to the benefit of all concerned, guarantees of quality are being enforced by statutory graders and standards : the social conscience is quickened regarding the obligation of all of us to serve the community of which we form a part. Control can be irksome from without, can do untold good from within. In other countries control has been drastic. You all know, for example, the conditions ruling in Canada.

The objects of the N.I.A.B. are to see that the farmer is supplied with unbiassed information regarding the germination, variety and productive value of the seeds he purchases. I have not said anything as regards the germination side. It is the privilege of an efficient and smooth-running machine, such as we have in the Official Seed Testing Station, under the able direction of Mr. Eastham, that it calls for no comment. You will find full particulars in his annual report just published.

I know that the interests of the leaders of the seed trade are the same as ours, and I sincerely trust that nothing I have said to-day will be misconstrued to the contrary. I should like to add here that I am not one of those who scorn the idea of "commercial interests". Nearly all researches are in fact working to further the "commercial interests" of someone or other. Nevertheless I can still vaguely remember the sense of horror with which I used to hear the words in the days when as a young man I was still working in a strictly academic atmosphere and before I myself got so degraded by contact with trade. I can still vaguely remember my amazement to find amongst my new colleagues men as disinterested and as conscientious as those I had left in the ranks of pure science.

What I have suggested is that it seems to me that the trade have not yet fully realised the extent to which we can help them, and that the Institute seeks not control but co-operation. I should like to ask the seed trade here and now "What other services can we render to them which we are not in fact rendering at present?" To answer this question requires perfectly frank and probably prolonged discussions between the two bodies. If my year of office can see the initiation of machinery for bringing about this closer co-operation, and this machinery in my view means closer and more frequent personal contact, then I shall indeed be happy.

THIRTEENTH SPECIAL GENERAL MEETING.

The Thirteenth Special General Meeting of Fellows of the Institute was held at the Potato Testing Station, Ormskirk, on the 1st August, 1935 for the purpose of inspecting the potato trials and plots.

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CONTENTS.

FOREWORD.

Although hitherto the Institute has not aimed at publication of numbers of this Journal either at any given interval or at any specific time of year but only as and when sufficient material had accumulated to make up a number of appropriate size, it has so happened that for several years past publication has in fact taken place in the late autumn. As a result, reports on trials carried out in the preceding growing season have usually not been compiled in time for inclusion, and a considerable time-lag in their appearance in print has resulted.

Beginning with this number, it is the Institute's intention to publish the Journal in future in the early part of the year. This procedure has already allowed lee-way to be made up both with reports on potato synonym work and on the work of the Official Seed Testing Station; this explains the simultaneous appearance of two reports on each.

The Potato Synonym Reports make gratifying reading, particularly as it can be stated that apart from the virtual disappearance of any new synonyms, a direct result of the work of the Committee has been that practically every firm selling the older potato synonyms has undertaken to remove them from its catalogues.

The Official Seed Testing Station reports demonstrate by the increasing number of samples submitted for trial, and by the absence of complaints, that confidence in its work continues to grow.

A further three years' work on sugar beet emphasizes the truly remarkable consistency of performances of the various strains produced by the leading breeders. Sugar beet for commercial purposes is invariably out-crossed, and yet in spite of this, the Institute's trials have shown that the type of the various so-called strains can be, and usually is, faithfully maintained year after year.

Work on potatoes figures prominently in the following pages. It is a sign of the times that cooking quality is assuming ever-increasing importance in estimating the commercial value of varieties. The report on the potato quality trials shows, however, how far we still are from the discovery of any rapid chemical or physical laboratory test for " quality ", or from being able precisely to define the factors, whether of soil, climate, fertilizer or variety, which determine this important characteristic. The " proof of the pudding " still remains " in the eating "; and the recipe for producing at will the potato of perfect eating quality is as yet undiscovered.

Included in this number of the Journal is the report of the Home Grown Wheat Committee of the National Association of British and Irish Millers on the quality for bread-making purposes of wheats harvested in 1935.

From 1924 until his death in 1935 the late Sir Albert Humphries and his colleagues and assistants at Coxes Lock Mills, Weybridge, carried out the investigations on which the reports of the Home Grown Wheat Committee were based. In 1935, at the request and at the expense of the National Association of British and Irish Millers the Research Association of British Flour

Millers undertook the investigations and the report included herein is the work of the Director of the Research Association, Dr. E. A. Fisher.

The Institute takes this opportunity of placing on record its sincere appreciation of the work carried out by the late Sir Albert Humphries and his colleagues during the years 1924 to 1933 and its grateful thanks to the National Association of British and Irish Millers for financing the work carried out by the Research Association in 1935. Acknowledgments are also made to Dr. Fisher for his assistance in this matter.

The Institute wishes to express its gratitude to the Director and staff of the Agricultural Institute, Kirton, for carrying out yield trials of spring oats and potatoes; to the Northumberland County Demonstration Farm, Cockle Park, and the Herts. Institute of Agriculture, St. Albans, for conducting trials of spring oats; also to Dr. L. H. Lampitt and the staff of Messrs. Lyons Research Laboratories for carrying out cooking tests of potatoes, and to Mr. C. J. Mapey for valuing oat samples derived from the yield trials.

The trials at the Institute's Headquarters Trial Grounds, Cambridge, the Potato Testing Station, Ormskirk, and the five sub-stations are supervised as follows :—

Cambridge :	by Mr. S. F. Armstrong, Manager of Field Plots, assisted by Mr. E. G. Thompson, Mr. B. Brandreth and Mr. T. W. Stops.
Ormskirk :	by Mr. H. Bryan, Superintendent of Potato Trials, assisted by Mrs. McDermott.
Cannington :	by Mr. G. E. Furse, Crop Recorder.
Long Sutton :	by Mr. A. J. Marval, Crop Recorder.
Newport :	by Mr. H. E. F. Maddrell, Crop Recorder.
Sprowston :	by Mr. W. Rimmer, Crop Recorder.
Askham Bryan :	by Mr. H. W. Simmons, Crop Recorder.

(Signed) WILFRED H. PARKER.

March, 1937.

TRIALS OF SUGAR BEET STRAINS, 1933-1935.

S. F. ARMSTRONG, M.A.

CONTENTS.

I.—MAIN TRIALS.

INTRODUCTION.

Of the following seven strains the first six were grown in trials in each of the three seasons at the four centres mentioned below; the last strain in the list was grown only in 1934 and 1935. Kleinwanzleben E was again used as control. In every case the seed was obtained direct from the breeder and was dressed with Agrosan G before sowing.

The strains included in the trials were :—

Strain	Source of seed
Kleinwanzleben E (control)	Zuckerfabrik Kleinwanzleben, Germany.
Kleinwanzleben N	do. do. do.
Dobrovice N	Company for Cultivation of Beetroot Seeds Ltd., Prague.
Dippe W.I.	Gebruder Dippe, Quedlinburg, Germany.
Kuhn P	Messrs. Kuhn & Co., Naarden, Holland.
Marsters' British Hilleshog	Messrs. C. W. Marsters Ltd., King's Lynn, Norfolk.
Johnson's Perfection	Messrs. W. W. Johnson & Son, Ltd., Boston, Lincs.

Each of these strains had been previously tested by the Institute in field trials, and the results had shown that they were all good strains when sown and lifted at normal periods in England. The Beet Sugar Factories Committee, however, desired to obtain further information on the comparative suitability for "early lifting" of the leading sugar beet strains grown in this country, and these were selected for this purpose. The dates of sowing therefore took place as early as climatic conditions would allow, and lifting was arranged to be done towards the end of September or early in October. As in previous years the trials were made possible through grants provided by the English beet sugar factories.

THE TRIAL STATIONS.

The four trial centres were situated in beet growing areas at the following four sub-stations :—

Somerset Farm Institute, Cannington, near Bridgwater.

In each season the trials here were grown on silty loam soil with red marl sub-soil, and between 40 and 70 ft. above sea level.

Harper Adams Agricultural College, Newport, Shropshire.

The trials were on rather light sandy loams with sandy sub-soil. The altitudes approximated to 200 ft.

Norfolk Agricultural Station, Sprowston.

The trials were grown here on medium loams at approximately 100 ft. above sea level.

Good Easter, near Chelmsford, Essex.

The trials were grown on a heavy calcareous clay, about 200 ft. above sea level.

The Essex station was closed down at the end of the 1934 season. In 1935, however, the trials were continued at Harswell in East Yorkshire as a branch centre of the newly formed Yorkshire sub-station at Askham Bryan. The soil at Harswell was a sandy silt of good depth and about 27 ft. above sea level.

GENERAL CONDITIONS OF CULTIVATION.

Except at Newport and Harswell, where low ridges were used, drilling was done on flat seed beds. The spacings between rows were 21½ inches at Good Easter, 20 inches at Newport, 19½ inches at Harswell, and 18 inches at the other centres. Seed was sown at the rate of 20 lbs. per acre at each station. Early sowing was attempted at all centres, and it was possible to drill all the trials in 1933 between the 13th and 26th April, and in 1934 between the 16th and 23rd April. In 1935 the sowings were delayed by unfavourable weather, and at Cannington drilling was not done until the 6th May; at the remaining centres, however, the sowing took place between the 20th and 30th April.

In all cases the trials followed a cereal crop. Except at Good Easter in 1934, dung was applied in the previous autumn for each of the crops, and this was supplemented by suitable applications of fertilisers. Dressings of lime were also applied in preparation for the crops at Newport in 1933 and at Harswell in 1935.

CLIMATIC CONDITIONS, ETC. (Tables I - II).

The 1933 season was exceptionally warm and dry, particularly from April to August inclusive. These conditions caused frequent wilting of the beet foliage and led to its premature yellowing, especially at Good Easter. Black Aphis (*Aphis rumicis*) caused slight general damage at all centres except Sprowston.

In 1934 the season was on the whole more favourable for the crop. Sufficient sunshine, combined with a higher rainfall, maintained a more normal growth. Aphis attack developed at Sprowston during July but was soon afterwards checked by rain. The only notable interference by pests in that year was at the same centre where wireworm reduced the plant populations.

The weather during 1935 was variable and not too favourable. A cold spring was followed by a hot dry period between mid-June and mid-August; from then until lifting time very unsettled and wet conditions prevailed. Leaf yellowing was general in August at Cannington and Sprowston, but the succeeding rains caused active re-growth.

METHOD AND RELIABILITY OF THE TRIALS.

Some of the strains in these trials had large tops and others comparatively small ones. Specially conducted trials had previously shown that some " interference " takes place when dissimilar strains are grown in single adjacent rows. Although the extent of such " interference " is small it has to be avoided if the results are to have a high standard of reliability. In the present trials, therefore, each strain was grown in strips of four rows each, of which the two inner rows only were used for trial purposes, the exterior rows being discarded. In each trial the strips of each strain were repeated five times in a randomized lay-out. The length of each row lifted and weighed occupied 1/80th of an acre, and the ten inner rows of each strain therefore covered 1/8th acre. At Newport in 1933 the trial area of each strain harvested was reduced to 1/10th of an acre, and at Sprowston in 1934 the area was reduced to 10/88ths of an acre owing to wireworm damage.

The Institute's standardized methods of sampling and analysing roots were followed as in previous years. The root yields are the yields of properly washed beet. All the cultural operations, notetaking, sampling, washing, etc. were in charge of a qualified resident Crop Recorder. The results are given in Table IV - VIII as a percentage of Kleinwanzleben E. The general average figures given are " straight " averages from which nothing has been excluded. As the strains were grown in randomized blocks the standard error of the mean yield was calculated for each trial. The standard error was reasonably low in all the trials except at Newport in 1935. The significant difference of root yield, expressed as a percentage of the control, is given in Table VI.

BOLTING.

The percentage of bolting plants is given in Table III. Dippe W.I. showed the greatest propensity to bolt followed by Dobrovice N. The proportion of bolters in the other strains was low. The tendency to bolt was greater at Sprowston and Harswell than at the other centres.

SIZE OF TOPS.

In each trial a comparison of " weight of top " was obtained between the control variety, Kleinwanzleben E, and the two strains with comparatively small tops - Marsters and Kuhn P. The weights of freshly cut tops were taken of 100 roots of each strain drawn at random. These tops were then allowed to wilt for from 10 - 14 days after which the " wilted weights " were taken.

Size of top is notoriously variable with season, soil conditions, spacing, etc. This is well shown by the fresh weights of 100 tops of Kleinwanzleben E which varied at the different centres between 48 lb. and 68 lb. in 1933; between 56 lb. and 143 lb. in 1934; and between 57 lb. and 113 lb. in 1935.

The average fresh weight of 100 tops over the three-year period (twelve trials) was

Kleinwanzleben E (control)	83 lb. (=100 per cent.)
Kuhn P	64 lb. (= 77·1 per cent.)
Marsters	62 lb. (= 74·7 per cent.)

The average " wilted weight " of 100 tops was

Kleinwanzleben E (control)	58 lb. (=100 per cent.)
Kuhn P	43 lb. (= 74·1 per cent.)
Marsters	41 lb. (= 70·7 per cent.)

PLANT POPULATIONS. (Table IV).

The plant populations were very good especially at Cannington and Newport. The lowest, at Sprowston in 1934, were the direct result of wireworm attack. The largest population differences between the strains in any single year were at Newport in 1935. Over the three-year period the greatest difference in population at any centre between any strain and the control never exceeded 7 per cent.; and on the basis of the general average population the difference between the highest and the lowest populations was only 5 per cent.; these figures may be regarded as satisfactory.

INDIVIDUAL ROOT WEIGHT AND SHAPE. (Table V).

The individual root weights were rather below those obtained from the same strains in previous trials and may be partly due to the earlier dates on which the present crops were lifted. The general average weight of Kleinwanzleben E was only 1·06 lb. as compared with 1·19 lb. over 1930-1932, and 1·10 lb. over 1927-1929. On a general average the heaviest roots were produced by Kleinwanzleben E and the lightest by Kuhn P.

The proportion of fangs appeared to depend more upon soil conditions than upon the strain. On the whole Marsters' British Hilleshog, the Kleinwanzleben strains and Kuhn P were the most satisfactory for shape and freedom from fangs, while Dobrovice N and Dippe W.I. were inclined to have more fangs than the others.

YIELD OF ROOTS. (Table VI).

In eight of the twelve trials the control strain - Kleinwanzleben E - significantly outyielded each of the others. In the seasons of 1933 and 1934 it significantly outyielded all other strains at Newport, Sprowston and Good Easter, and it did the same at Cannington in 1934 and 1935.

Kleinwanzleben E also significantly outyielded all strains except Dippe W.I. at Cannington in 1933, while in the remaining three trials it significantly outyielded each of the other strains at least once. In no single trial did any of the other strains reach the yield given by Kleinwanzleben E. Including all the trials over the three seasons Kleinwanzleben E gave an average yield considerably higher than that of any other strain.

Kleinwanzleben N was outyielded significantly by Kleinwanzleben E in ten out of the twelve trials, but on no occasion was it outyielded to a significant extent by any other strain. It gave yields significantly greater than Dobrovice or Kuhn in five trials, greater than Marsters in four trials, and greater than Dippe or Johnsons in two trials. At Good Easter in 1934

it significantly outyielded all the strains except the control. Its average yield was about 9 per cent. below the control.

Dippe W.I. was outyielded to a significant extent by the control in ten out of twelve trials. It significantly outyielded Dobrovice in four trials, Kuhn in three, and Marsters in two trials. On an average its yield was about 11 per cent. below the control.

Marsters was outyielded significantly by Kleinwanzleben E in ten out of twelve trials. It significantly outyielded Dobrovice in three trials, and Kuhn and Johnsons each on one occasion. It yielded on an average about 11 per cent. below the control.

Dobrovice was outyielded to a significant extent by the control in ten out of twelve trials. It outyielded Marsters significantly in two trials and Kuhn and Johnsons each on one occasion. Its average yield was some 12 per cent. below Kleinwanzleben E.

Kuhn P was outyielded significantly by the control on ten out of twelve occasions. It gave significantly higher yields than Dobrovice twice and higher than Dippe or Johnsons on one occasion each. Its yield was on an average 13 per cent. below the control.

Johnson's Perfection was outyielded to a significant extent by Kleinwanzleben E in six out of eight trials in which it was grown. It significantly outyielded Dobrovice on one occasion.

SUGAR CONTENT OF ROOTS. (Table VII).

The control strain, Kleinwanzleben E, had on an average the lowest sugar contents, but this was associated, as in previous years, with the highest average root weight. Its average sugar content for the three seasons was 16·82 per cent.

The highest average content of sugar was given by Marsters, closely followed by Kuhn P, Dobrovice N and Johnson's Perfection. The sugar content of Kleinwanzleben N and Dippe W.I. was still slightly lower than the foregoing, but distinctly higher than that of Kleinwanzleben E.

YIELD OF SUGAR. (Table VIII).

Although, as mentioned above, Kleinwanzleben E had the lowest average sugar content this was more than compensated for by its higher root weight and yield, with the result that its general average yield of sugar - 2·26 tons per acre - was higher than that of any other strain. On the average Kleinwanzleben N and Marsters produced some 5 per cent., and the other strains some 7 or 8 per cent. less sugar than Kleinwanzleben E.

COMPARATIVE CASH VALUE OF THE STRAINS. (Table IX).

This was arrived at by taking together (*a*) the yield of washed beet, (*b*) the sugar content, and (*c*) the price per ton paid by the factory. The actual price paid for sugar beet varied from year to year and differed slightly between the factories, but for the purpose of comparison 36/- per ton for 15½ per cent. sugar content beet has been allowed here, with an addition or deduction at the usual rate of 2/6d. for each one per cent. above or below 15½ per cent. The general average value of each strain on this basis is given in Table IX where the different values are also shown as a percentage of Kleinwanzleben E

II.—TRIALS AT SELBY.

The same seven strains were grown in trials near Selby in co-operation with the Yorkshire Sugar Company Limited who supervised the cultivation of the crop and did the root sampling and analyses. The seed used in the trials was also supplied by the Company. The objects and method of the trials were the same as those at the Institute's Sub-stations described above.

CONDITIONS OF CULTIVATION.

Although the trials were on different farms each year the situations were not far apart, and the soils were similar in character, each being a sandy loam of good depth. The level of fertility, however, was more variable; the land used in 1933 was in a high state of fertility, while that used in 1935 was below the average in this respect. These differences were reflected in the yields.

Each year the land received a dressing of lime and an ample application of complete fertilisers, but dung was applied only to the 1933 crop.

The seed was sown on a flat seed bed on the 3rd May in 1933 and 1934, and on the 30th April in 1935. The spacings between the rows were 21 inches in 1933 and 20 inches in the following seasons. Black Aphis attacked the 1933 crop, but its spread was checked by repeated spraying with Destromite. No other pests or diseases were encountered. The growth and yields of the 1933 and 1935 crops were, however, reduced to some extent by long spells of dry weather. The crops were sampled, lifted, washed, and weighed each season during the latter part of October. Although the lifting was done later than at the Institute's Sub-stations it was definitely early in comparison with the bulk of the sugar beet crop in Yorkshire.

FIELD BEHAVIOUR OF THE STRAINS.

Dobrovice had very large tops, much larger than any other strain. Dippe and the two Kleinwanzleben strains had fairly large erect tops. Kuhn and Johnsons had tops of moderate size, while those of Marsters were the smallest. The amount of top in each case was much less in 1935 than in the previous years. There was a greater tendency to bolt in 1935 than in the other seasons, but only in the case of Dippe was the number of bolters serious. Marsters and Kuhn were very free from bolting. Dobrovice, on the whole, was inclined to have more fanged roots than the other strains.

PLANT POPULATIONS AND INDIVIDUAL ROOT WEIGHTS. (Table X).

The plant populations were excellent in each season. They were very constant between the strains in 1933 and 1934, but less so in 1935. The average root weights were satisfactory, except in 1935 where the low weight is attributable to the rather low soil fertility, the dryness of the season, and the high plant populations. An exceptional feature in 1935 was that the average root weight of Kleinwanzleben E was lower than that of any other strain; this is not entirely explained by the high population of Kleinwanzleben E for the populations of Dobrovice and Johnsons were at least as high.

YIELD OF WASHED ROOTS. (Table XI).

The standard errors were low except in the 1935 trial. Kleinwanzleben E outyielded all the other strains to a significant extent in 1933; in 1934 it significantly outyielded Dobrovice and Dippe. In none of the trials was it outyielded significantly by any other strain. Dobrovice and Dippe each gave significantly higher yields than Kuhn in 1933. Kleinwanzleben N and Marsters each yielded significantly higher than Dobrovice and Dippe in 1934. Owing to the low reliability of the 1935 results the large difference of 16·2 per cent. of the control is required for significance, and in that trial only the higher yield of Dobrovice over Dippe appears to be significant.

SUGAR CONTENT OF ROOTS AND YIELD OF SUGAR. (Tables XI and XII).

The sugar contents were rather low in 1933, but satisfactory in the two following years. On an average of the three seasons Kleinwanzleben E had a sugar content of 17·5 per cent. Contrary to the usual state of affairs Dippe W.I. in 1934 and Kleinwanzleben N in 1934 and 1935 had slightly lower sugar contents than Kleinwanzleben E. The differences in sugar content were not large, but on an average Kuhn P had the highest percentage. In yield of sugar Johnson's Perfection (on two years' results only) took the first place. On the average of the three years' trials Kleinwanzleben E gave a higher sugar yield than any of the other five strains, though its advantage over Dobrovice was insignificant.

VALUE PER ACRE.

The strains are given in Table XII in the order of their average value per acre on the basis of 36/- per ton for 15½ per cent. roots. Kleinwanzleben E took the premier position and Dippe W.I. the lowest. Except for these, the value between the different strains per acre was not great.

III.—SUPPLEMENTARY TRIALS.

Additional trials of sugar beet were made in 1933-35 at the Institute's sub-stations. The trial centres, soils, manuring and general cultural treatments were the same as already described above under the main trials. The strains tested were :—

Strain	Source of seed
Kleinwanzleben E (control)	Zuckerfabrik Kleinwanzleben, Germany.
Delitzscher E	Messrs. Delitzscher Rubensamenzucht G.m.b.H., Delitzsch, Saxony.
Danish 31-IV	Danish Sugar Factories, Denmark.
Glostrup B	Hjalmar Hartmann & Co., Copenhagen, Denmark.
Schmidt A	H. Schmidt, Rittergut Ober-Thiemendorf, Kr. Lauban, Schlesien, Germany.

The dates of sowing were as follows :—

	1933.	1934.	1935.
Cannington ...	10th May	8th May	9th May
Newport ...	8th May	1st May	10th May
Sprowston ...	20th April	25th April	23rd April
Good Easter ...	28th April	18th April	—
Harswell ...	—	—	29th April

The long drought in the summer of 1933 checked the growth of the crops and some wilting and premature yellowing occurred during July and August. A rather severe attack of Black Aphis occurred at Cannington in June and July, and the rather low yields at that centre were largely due to this. Some loss of plant was caused at Sprowston by wireworm in 1934. These were the only serious disturbing causes to growth throughout these trials.

The crops were lifted on the following dates :—

	1933	1934	1935
Cannington	1st-7th November	11th-17th October	10th-15th October.
Newport	1st-7th November	5th-9th November	4th-6th November
Sprowston	24th October	21st November	15th-26th November
Good Easter	1st-7th November	30th October	—
Harswell	—	—	11th November

FIELD BEHAVIOUR OF THE STRAINS.

Bolting was more in evidence at Sprowston than elsewhere, but the percentage of bolters was not high in any strain. On an average the percentage of bolters was quite low for each strain. The tops of all the strains were of the large erect type and the differences between strains were not great; on the whole the tops of Danish 31-IV were inclined to be slightly smaller than the others. All the strains produced roots of satisfactory shape.

PLANT POPULATIONS AND INDIVIDUAL ROOT WEIGHT. (Tables XIV and XV).

The plant populations were satisfactory in all the trials, and usually high. The comparatively low populations of Delitzscher at Newport in 1935, and of Schmidt at each centre in the same year, probably affected the yield of these strains. On the general average, however, the populations did not differ greatly from that of the control.

The average root weights were good except at Newport and Cannington in 1933. At the former centre this was due to the sandy character of the soil on which the full effect of the drought was felt; at Cannington the low root weight was due to drought and Aphis attack. On the general average Schmidt A had a very slightly higher root weight than the control, but this was probably due to its lower average population. The other three strains had decidedly lower root weights than the control at all centres; the exceptional case of Delitzscher at Newport in 1935 was obviously due to an unusually low population.

YIELD OF ROOTS. (Table XVI).

Owing to the low and variable plant populations at Good Easter in 1934 the standard error in that trial was exceptionally high. None of the yield differences was significant and the results are given in Tables XIV - XIX for the purpose of record only.

In the remaining eleven trials Schmidt A significantly outyielded Glostrup and Delitzscher each in five trials and the Danish strain in seven trials. Schmidt A was outyielded by the control only on three occasions, and on the general average its yield was not much below that of Kleinwanzleben E. Glostrup B outyielded to a significant extent Delitzscher in four trials and Danish 31-IV in five trials. It was outyielded by the control in seven trials, and on an average gave about 7 per cent. lower yield of roots.

Delitzscher yielded significantly better than Glostrup once, and better than the Danish strain on two occasions. It was significantly outyielded by the control nine times and produced on an average about 9 per cent. less weight of roots.

Danish 31-IV in one trial (Newport, 1935) gave a significantly higher yield than Delitzscher, but this exceptional result, as noted above, was clearly due to the deficient population of Delitzscher in that trial. The Danish strain was significantly outyielded by Kleinwanzleben E in nine out of eleven trials, and on an average gave a yield some 12 per cent. lower.

SUGAR CONTENT OF ROOTS. (Table XVII).

Except in the Good Easter trial of 1934 the sugar contents were comparatively low at all centres and in each season. The differences between strains were not marked, but Danish 31-IV and Delitzscher E took the first and second places respectively for sugar contents in ten out of eleven trials. Glostrup and Schmidt each on an average had similar sugar contents to the control.

YIELD OF SUGAR. (Table XVIII).

On the general average the control strain gave the high yield of 2·423 tons of sugar per acre. Schmidt yielded some 5 per cent. less, and the other strains from 7 - 8 per cent. less sugar per acre.

VALUE OF THE CROP.

The cash value per acre shown in Table XIX is based on a price of 36/- per ton for 15½ per cent. beet. It will be seen that the average value of Schmidt A was 5 per cent. lower than that of Kleinwanzleben E, and the value of the other strains from 7 - 8 per cent. lower.

IV.—TRIALS ON FEN LAND, 1935.
(Table XX).

A trial of Kuhn E and Dobrovice N with Marsters' British Hilleshog as the control was conducted at Black Horse Drove, Littleport, in 1935, but the trial was not repeated owing to lack of funds.

The trial was on black land of good depth with clay about three feet below. The previous crop was wheat and the stubble was deeply ploughed

in during the autumn of 1934. No dung was applied, but the seed bed received 5 cwts. per acre of a complete mixture of artificials. The seed came direct from the breeders and was dressed with Agrosan G before sowing. The trial was drilled on the 26th April in rows 22 inches apart. Discard rows were sown to separate the different strains, and the lay-out was as described above under the main trials.

In the strain Dobrovice the number of plants per acre was under average, but in the other strains the plant populations were normal for the wide row spacing usual in the district. The growth during the season was normal and healthy. Dobrovice produced very large tops from 24 - 30 inches high. Kuhn E had tops of very uniform type about 20 - 24 inches high and inclined to spread. Its leaves were of a darker green colour than the other strains and remained so until the date of lifting. The tops of Marsters were also very uniform in shape but smaller—about 14 - 18 inches high—and inclined to spread. The leaves of Marsters showed some signs of yellowing at the lifting date, while Dobrovice had paler foliage than the others.

The roots were lifted on the 26th November and were topped and washed on the 28th and 29th. Each strain had roots of good shape and fairly free from fangs. The higher root weight of Dobrovice was probably due to its thinner population, but that of Kuhn E was less satisfactory than Marsters. Although the root yields were very high for each strain Marsters gave significantly higher yields than the other two. The sugar contents were low and similar in each strain. In yield of sugar Marsters took the first place.

REVIEW OF THE STRAINS.

(a) Strains in the main trials.

Kleinwanzleben E. With two or three exceptions (in the Selby trials) this strain produced the heaviest roots and the highest root yield per acre, but its sugar content was lower than that of the others. On an average it took the first place for yield of sugar and value per acre. Its root shape was good and the proportion of bolters low.

Kleinwanzleben N. This came second for root weight and yield. Its average sugar content was not notably higher than that of Kleinwanzleben E, and exceptionally at Selby in 1934 and 1935 its sugar contents were slightly lower. Its yield of sugar was some 5 per cent. below the control. Its root shape was good and it did not bolt more than Kleinwanzleben E.

Marsters' British Hilleshog. The strain had a good average root weight, though lower than that of the control. It gave relatively better results at Selby where its average yield was 96·3 per cent. of the control as compared with an average yield of 88·5 per cent. at the other centres. On the average its sugar content was higher than all the other strains except Kuhn P. In yield of sugar and value per acre it gave similar results to Kleinwanzleben N. Its roots were invariably of good uniform shape. It bolted less than any other strain, in fact in nine of the trials bolters were almost non-existent.

Dobrovice N. This had an average root weight and yield almost equal to Kleinwanzleben E at Selby, but on an average of results at the other

centres its yield was only 87·3 per cent. of the control. Its sugar content was good, and on an average higher than all except Marsters and Kuhn. Its yield of sugar was similar to that of the control at Selby, but some 8 per cent. lower than the control on the average of the other centres. Its root shape was constant, but in some trials it produced more than the usual number of fanged roots. It produced very large erect tops—larger than the other strains. Although its average figure for bolting was not high it was occasionally inclined to bolt rather badly.

Dippe W.I. This strain had a definitely lower root weight than the control and only distinctly better than Kuhn P among the other strains. Its yield was about 8 per cent. below the control at Selby and 11 per cent. on the general average of the other trials. Its sugar content was rather higher than the control, but on an average it yielded about 8 per cent. less sugar. It had roots of fairly constant shape, though sometimes inclined to be rather fanged. Its tops were slightly smaller than the control and it was sometimes inclined to bolt rather badly.

Kuhn P. This had on an average the lowest root weight. Its yield of roots was also comparatively low, 93·3 per cent. of the control at Selby, and 87 per cent. on the general average of other centres. It sugar content was distinctly good, and on an average equal to Marsters. Its yield of sugar was lower than the control by 2 per cent. at Selby and by about 7 per cent. on an average of the other trials. Its roots were of good shape and usually free from fangs. It had tops of medium size, intermediate in bulk between Marsters and Kleinwanzleben E. The percentage of bolters was always low in this strain which, after Marsters, was the least inclined to bolt.

Johnson's Perfection. This was tested in two seasons only in the present series of trials. In root weight and yield it was equal to the control at Selby, but considerably lower in these respects on the average of the other trials. Its sugar contents were good and on an average similar to Marsters, Kuhn and Dobrovice. Its yield of sugar was higher than Kleinwanzleben E at Selby, but some 8 per cent. lower on an average at the other centres. In general field behaviour, root shape, root yields and sugar contents Johnson's gave similar results to Kuhn P.

(b) Strains in the supplementary trials.

Schmidt A. This had a similar root weight and sugar content to Kleinwanzleben E, but on an average gave a slightly lower yield, and about 5 per cent. less sugar per acre. It had well shaped roots, and tops equal in size to the control. It was occasionally inclined to bolt but never to a serious extent.

Delitzscher E. On an average this had a root weight some 8 per cent. below the control, and yielded about 9 per cent. less. Its sugar content was slightly higher than Kleinwanzleben E, but on an average its yield of sugar was about 7 per cent. less. Its tops were similar in size to the control and its roots were constant in shape. Like Schmidt A it was sometimes inclined to bolt, but never to a large extent.

Glostrup B. This, on an average, had a root weight 9 per cent. below the control, and gave a yield some 7 per cent. lower. Its sugar content was

equal to the control, but its yield of sugar about 7 per cent. less. It produced well shaped roots, had tops similar in size to the control, and resisted bolting to a similar extent.

Danish 31-IV. This strain had a comparatively low root weight, on an average being only 88 per cent. of the control; its relative yield of roots was also the same. In sugar content it was always better than the control, though the average difference was not great. In both yield of sugar and value per acre it was about 8 per cent. below Kleinwanzleben E. Its roots were of uniform shape and its tops rather smaller than those of the control It was usually very resistant to bolting.

CONCLUSIONS.

The results of the present trials confirm those of past seasons in showing that Marsters' British Hilleshog, Kleinwanzleben N, Kuhn P, Johnson's Perfection, Dobrovice N and Dippe W.I. are all good strains, none of which is markedly superior to the others in yield of sugar or value per acre. Each of them has a satisfactory root shape. Owing to their greater tendency to bolt it is clear that both Dippe W.I. and Dobrovice N are less suitable for very early sowing than the others, while Marster's British Hilleshog is the most suitable for this purpose. Where the question of high sugar contents have specially to be considered the merits of Marsters, Kuhn P and Dobrovice N are worth attention.

Schmidt A, Glostrup B, Delitzscher E and Danish 31-IV are also useful strains, approximating to the "E" type, and suitable for comparatively late lifting. They have roots of good shape and none of them bolts to a serious extent.

Kleinwanzleben E has maintained its position of former years and is still unsurpassed for yield of sugar and value per acre on a wide variety of soils. Even for early sowing and comparatively early lifting it is a good strain, but it is more suitable for normal or relatively late lifting, when it gives its highest returns.

Table I.

MONTHLY RAINFALL AT THE TRIAL STATIONS - IN INCHES - SEASONS 1933-35.

Month	Cannington			Newport			Sprowston			Good Easter		Harswell
	1933	1934	1935	1933	1934	1935	1933	1934	1935	1933	1934	1935*
January	1·71	2·50	0·61	1·55	2·27	1·04	0·81	1·38	3·09	1·30	1·28	1·93
February	3·74	0·22	2·88	3·31	0·38	2·49	1·99	0·72	1·85	0·93	0·27	2·65
March	2·72	2·08	1·00	2·42	1·65	0·63	1·94	1·12	0·59	1·76	2·00	0·77
April	1·17	2·61	4·37	0·91	2·33	3·08	1·30	2·27	2·34	1·36	2·18	1·93
May	1·98	1·03	1·51	1·29	1·08	0·93	1·73	2·34	1·43	1·64	0·36	1·07
June	1·73	2·46	2·43	1·78	1·19	2·63	2·08	1·82	2·98	1·32	1·24	2·38
July	1·21	0·25	0·45	1·72	1·62	0·56	1·18	1·29	0·91	1·10	1·67	0·35
August	0·77	4·24	1·92	0·78	2·23	1·25	0·81	2·51	1·21	0·30	1·42	2·23
September	1·96	1·94	3·53	0·67	1·57	2·96	2·53	1·78	2·82	2·13	1·40	5·20
October	3·34	3·23	4·23	4·08	2·15	3·54	2·41	1·45	3·03	1·58	†	4·80
November	0·74	1·14	5·80	0·95	2·05	4·37	2·37	1·77	3·50	1·03	†	4·09
December	1·00	6·38	4·19	0·35	3·62	2·20	0·72	3·43	1·51	0·58	†	2·43
Total for year	22·07	28·08	32·92	19·81	22·14	25·68	19·87	21·88	25·26	15·03	—	29·83

† No figures available.

* Records taken at York.

Table II.

MONTHLY SUNSHINE AT THE TRIAL STATIONS - IN HOURS - SEASONS 1933-35.

Month	Cannington			Newport			Sprowston			Good Easter		Harswell
	1933	1934	1935	1933	1934	1935	1933	1934	1935	1933	1934	1935*
January	85·3	56·6	56·8	72·5	62·9	47·1	61·1	59·3	50·8	54·1	39·9	41·5
February	96·5	95·8	68·0	89·0	82·2	54·8	79·7	122·0	59·4	88·9	94·5	38·0
March	183·2	126·4	121·9	145·6	102·7	101·4	190·1	121·1	139·0	186·8	113·5	88·3
April	172·9	143·9	145·6	145·9	126·8	135·2	161·2	118·3	133·7	156·4	119·8	132·7
May	207·2	227·1	166·2	140·0	162·9	228·0	187·4	200·2	272·9	170·7	213·2	254·1
June	252·2	227·8	208·1	199·6	198·1	154·0	217·1	189·5	231·9	237·5	211·6	164·0
July	243·3	283·0	267·3	214·7	227·7	232·8	227·5	264·6	302·7	228·0	277·1	239·7
August	245·2	198·4	208·9	206·1	161·6	188·7	230·6	197·6	209·5	256·3	181·6	193·5
September	158·5	154·9	151·9	168·0	147·1	142·4	177·2	202·9	164·4	190·4	173·8	141·8
October	92·5	76·2	89·8	79·6	75·3	82·0	91·7	107·0	119·7	107·9	†	87·1
November	81·3	22·1	68·0	44·7	38·3	65·0	34·4	56·0	58·4	57·9	†	35·7
December	50·3	41·4	53·0	30·8	30·9	38·1	42·1	22·3	44·4	43·2	†	49·5
Total for year	1868·4	1653·6	1605·5	1536·5	1416·5	1469·5	1700·1	1660·8	1786·8	1778·1	—	1465·9

† No figures available.

* Records taken at York.

Table III.

MAIN TRIALS, 1933-1935.

PERCENTAGE OF BOLTERS.

The strains are arranged in the order of the general average percentage of bolters.

Strain	Cannington			Newport			Sprowston			Good Easter		Harswell	General average
	1933	1934	1935	1933	1934	1935	1933	1934	1935	1933	1934	1935	
Marsters	0·03	0·05	0·00	No bolters present.	0·13	0·00	0·36	0·04	0·20	0·00	0·12	0·41	0·11
Kuhn P.	0·00	0·19	0·28		0·81	0·03	0·56	0·19	0·52	0·07	0·42	0·37	0·29
Kleinwanzleben E (control)	0·00	0·24	0·00		0·78	0·32	0·59	0·63	0·77	0·05	0·48	0·38	0·35
Kleinwanzleben N	0·08	0·24	0·05		1·00	0·16	1·32	0·77	0·79	0·08	0·29	1·22	0·50
Johnson's Perfection	—	0·70	0·54		1·14	0·17	—	1·56	1·64	—	0·19	1·42	[0·92]
Dobrovice N	0·34	1·07	0·38		3·39	0·55	4·75	3·44	2·30	0·25	0·74	2·65	1·66
Dippe W.I.	0·18	1·91	1·29		4·58	0·98	3·60	4·73	4·92	0·11	0·43	5·01	2·31
Average of all strains	0·11	0·63	0·36		1·69	0·32	1·86	1·62	1·59	0·09	0·38	1·64	0·86

Table IV.

MAIN TRIALS, 1933-1935.

NUMBER OF ROOTS PER ACRE EXPRESSED AS A PERCENTAGE OF KLEINWANZLEBEN E.

The strains are arranged in the order of the general average number of roots per acre.

Strain	Cannington				Newport				Sprowston				Good Easter		Harswell	General average
	1933	1934	1935	1933-1935	1933	1934	1935	1933-1935	1933	1934	1935	1933-1935	1933	1934	1935	
Kuhn P	99	99	103	100·3	103	100	91	98·0	100	100	109	103·0	111	102	111	102·3
Dobrovice N ...	98	103	105	102·0	101	96	95	97·3	95	97	105	99·0	109	98	101	100·3
Kleinwanzleben E (control) ...	100	100	100	100·0	100	100	100	100·0	100	100	100	100·0	100	100	100	100·0
Marsters	96	103	103	100·7	103	98	85	95·3	99	100	103	100·7	100	102	105	99·8
Dippe W.I ...	100	98	104	100·7	106	101	80	95·7	100	99	104	101·0	102	98	99	99·3
Kleinwanzleben N	99	101	103	101·0	107	99	89	98·3	96	87	97	93·3	105	95	102	98·3
Johnson's Perfection ...	—	103	103	[103·0]	—	100	86	[93·0]	—	86	103	[94·5]	—	94	103	[97·3]
Number of roots per acre of Kleinwanzleben E ...	31,352	29,936	30,368	30,552	32,590	30,872	27,608	30,357	26,992	23,654	26,952	25,866	29,160	26,416	29,520	28,785

Table V.

MAIN TRIALS, 1933-1935.

WEIGHT OF INDIVIDUAL ROOTS EXPRESSED AS A PERCENTAGE OF KLEINWANZLEBEN E.

The strains are arranged in the order of their general average root weights

Strain	Cannington				Newport				Sprowston				Good Easter		Harswell	General average
	1933	1934	1935	1933-1935	1933	1934	1935	1933-1935	1933	1934	1935	1933-1935	1933	1934	1935	
Kleinwanzleben E (control) ...	100	100	100	100·0	100	100	100	100·0	100	100	100	100·0	100	100	100	100·0
Kleinwanzleben N	94	90	91	91·7	85	93	99	92·3	95	105	97	99·0	86	100	86	93·4
Johnson's Perfection ...	—	83	86	[84·5]	—	91	99	[95·0]	—	104	91	[97·5]	—	90	80	[90·5]
Dippe W.I ...	94	89	88	90·3	88	87	105	93·3	92	92	83	89·0	88	87	90	90·3
Marsters	86	83	87	85·3	86	93	91	90·0	92	94	96	94·0	84	86	90	89·0
Dobrovice N ...	86	85	85	85·3	81	88	99	89·3	89	88	88	88·3	80	87	91	87·3
Kuhn P	84	84	86	84·7	74	88	100	87·3	92	94	88	91·3	74	82	82	85·7
Average weight of Kleinwanzleben E roots, lb.	0·88	1·40	1·16	1·15	0·73	1·21	0·96	0·97	1·10	1·39	0·78	1·09	0·91	1·00	1·15	1·06

Table VI.

MAIN TRIALS, 1933-1935.

YIELDS OF WASHED ROOTS PER ACRE EXPRESSED AS A PERCENTAGE OF KLEINWANZLEBEN E.

The strains are arranged in the order of their general average yields.

Strain	Cannington				Newport				Sprowston				Good Easter		Harswell	General average
	1933	1934	1935	1933–1935	1933	1934	1935	1933–1935	1933	1934	1935	1933–1935	1933	1934	1935	
Kleinwanzleben E (control) ...	100	100	100	100·0	100	100	100	100·0	100	100	100	100·0	100	100	100	100·0
Kleinwanzleben N	92	91	93	92·0	91	92	88	90·3	91	91	95	92·3	90	94	88	91·3
Dippe W.I ...	94	87	91	90·7	93	87	84	88·0	91	91	87	89·7	91	84	90	89·2
Marsters	83	86	90	86·3	89	91	77	85·7	90	93	98	93·7	83	87	95	88·5
Dobrovice N ...	84	88	89	87·0	82	84	94	86·7	85	85	92	87·3	87	85	92	87·3
Johnson's Perfection ...	—	85	88	[86·5]	—	91	85	[88·0]	—	89	93	[91·0]	—	84	82	[87·1]
Kuhn P	83	83	89	85·0	76	87	90	84·3	92	93	95	93·3	82	83	91	87·0
Significant difference = ± per cent. of control	6·75	4·65	7·00	—	8·13	5·19	16·60	—	3·69	6·69	7·80	—	3·66	4·77	8·80	
Yield of Kleinwanzleben E in tons per acre ..	12·38	18·70	15·76	15·61	10·60	16·65	11·81	13·02	13·28	14·70	9·45	12·48	11·81	11·84	15·19	13·51

Table VII.

MAIN TRIALS, 1933-1935.

SUGAR CONTENT OF ROOTS EXPRESSED AS A PERCENTAGE OF KLEINWANZLEBEN E.

The strains are arranged in the order of their general average sugar content.

Strain	Cannington				Newport				Sprowston				Good Easter		Harswell	General average
	1933	1934	1935	1933–1935	1933	1934	1935	1933–1935	1933	1934	1935	1933–1935	1933	1934	1935	
Marsters	109·9	110·4	106·3	108·9	102·9	108·2	100·0	103·7	111·8	108·9	110·1	110·3	105·1	103·7	107·1	107·0
Kuhn P	108·7	104·0	106·3	106·3	102·9	110·0	103·6	105·5	113·1	107·5	107·7	109·4	104·3	104·3	104·5	106·4
Dobrovice N ...	108·4	106·3	104·2	106·3	105·1	110·0	103·6	106·2	105·9	108·2	101·8	105·3	102·4	104·8	104·5	105·4
Johnson's Perfection ...	—	106·9	105·6	[106·3]	—	110·0	101·2	[105·6]	—	105·7	104·2	[105·0]	—	104·3	101·9	[105·0]
Kleinwanzleben N	104·9	101·7	104·9	103·8	101·9	105·3	103·6	103·6	103·3	103·8	109·5	105·5	102·2	103·7	·103·9	104·1
Dippe W.I ...	101·4	104·6	104·2	103·4	101·3	110·5	100·6	104·1	102·0	105·7	106·5	104·7	101·6	104·3	101·3	103·7
Kleinwanzleben E (control) ..	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0
Percentage of sugar in Kleinwanzleben E ..	17·25	17·30	14·40	16·32	18·65	17·00	16·50	17·38	15·30	15·80	16·80	15·97	18·60	18·70	15·50	16·82

Table VIII.

MAIN TRIALS, 1933-1935.

YIELD OF SUGAR PER ACRE EXPRESSED AS A PERCENTAGE OF KLEINWANZLEBEN E.

The strains are arranged in the order of their general average sugar yields.

Strain	Cannington				Newport				Sprowston				Good Easter		Harswell	General average
	1933	1934	1935	1933-1935	1933	1934	1935	1933-1935	1933	1934	1935	1933-1935	1933	1934	1935	
Kleinwanzleben E (control) ...	100	100	100	100·0	100	100	100	100·0	100	100	100	100·0	100	100	100	100·0
Kleinwanzleben N	97	93	97	95·7	92	97	92	93·7	94	95	104	97·7	92	98	91	95·2
Marsters	91	94	95	93·3	91	99	77	89·0	100	101	109	103·3	87	90	102	94·7
Kuhn P	90	86	94	90·0	78	96	93	89·0	104	100	103	102·3	85	87	95	92·6
Dippe W.I ...	95	90	96	93·7	94	96	85	91·7	93	96	92	93·7	92	88	91	92·3
Dobrovice N ...	91	93	93	92·3	86	93	97	92·0	90	92	93	91·7	89	90	96	91·9
Johnson's Perfection ...	—	91	94	[92·5]	—	100	86	[93·0]	—	94	97	[95·5]	—	88	84	[91·8]
Yield of sugar in tons per acre from Kleinwanzleben E	2·14	3·24	2·27	2·55	1·98	2·83	1·95	2·25	2·03	2·32	1·59	1·98	2·20	2·21	2·35	2·26

Table IX.

MAIN TRIALS, 1933-1935.

GENERAL AVERAGE VALUE OF SUGAR BEETS PER ACRE, 1933-1935

The strains are arranged in the order of their value per acre.

Strain	Average weight of washed beets	Average sugar content	Average price per ton at factory	Average value of roots per acre	Average value as per cent. of Klein. E
	Tons per acre	Per cent.	s. d.	£ s. d.	Per cent.
Kleinwanzleben E (control)	13·51	16·8	39 3	26 10 3	100
Kleinwanzleben N	12·34	17·5	41 0	25 5 11	95
Marsters British Hilleshog	11·96	18·0	42 3	25 5 4	95
*Johnson's Perfection	12·43	17·4	40 9	25 6 6	95
Kuhn P	11·78	17·9	42 0	24 14 9	93
Dippe W.I.	12·03	17·4	40 9	24 10 2	92
Dobrovice N	11·79	17·8	41 9	24 12 3	93

* Average of two years.

Table X.

TRIALS AT SELBY, 1933-35.

NUMBER AND WEIGHT OF ROOTS AND PERCENTAGE OF BOLTERS.

Strain	Number of roots as percentage of control				Weight of individual roots as percentage of control				Percentage of bolters			
	1933	1934	1935	1933–1935	1933	1934	1935	1933–1935	1933	1934	1935	1933–1935
Kleinwanzleben E (control) ...	100	100	100	100·0	100	100	100	100·0	0·51	0·58	3·50	1·53
Kleinwanzleben N	97	97	89	94·3	92	102	113	102·3	0·53	0·81	3·10	1·48
Dobrovice N	99	95	100	98·0	93	94	110	99·0	1·46	1·76	1·45	1·56
Marsters	102	99	96	99·0	84	101	109	98·0	0·03	0·03	0·00	0·02
Kuhn P	104	105	91	100·0	79	93	110	94·0	0·17	0·12	0·15	0·15
Dippe W.I.	104	97	91	97·3	87	93	103	94·3	0·71	2·04	5·45	2·73
*Johnson's Perfection	—	103	102	[102·5]	—	95	106	[100·5]	—	0·37	0·47	[0·42]
Number of roots per acre of Kleinwanzleben E	31,210	31,456	35,240	32,635	—	—	—	—	—	—	—	—
Average weight of Kleinwanzleben E roots, lb. ..	—	—	—	—	1·10	0·96	0·70	0·92	—	—	—	—

* Results for two years only.

Table XI.

TRIALS AT SELBY, 1933-35.

YIELD OF WASHED ROOTS AND SUGAR CONTENTS.

The strains are given in the order of their average root yields.

Strain	Yield of roots as percentage of control				Sugar content as percentage of control			
	1933	1934	1935	1933-1935	1933	1934	1935	1933-1935
*Johnson's Perfection	—	98	108	(103·0)	—	100·6	101·1	(100·9)
Kleinwanzleben E (control)	100	100	100	100·0	100·0	100·0	100·0	100·0
Dobrovice N	92	89	111	97·3	102·7	104·0	101·1	102·6
Kleinwanzleben N	89	100	100	96·3	102·4	96·6	98·9	99·3
Marsters	85	100	104	96·3	108·1	100·6	97·7	102·1
Kuhn P	82	98	100	93·3	104·5	105·1	104·4	104·7
Dippe W.I.	91	90	94	91·7	101·5	99·4	100·5	100·5
Significant difference = ± per cent. of control	7·44	4·35	16·20	—	—	—	—	—
Yield of Kleinwanzleben E, tons per acre	15·33	13·45	10·98	13·25	—	—	—	—
Percentage of sugar in Kleinwanzleben E	—	—	—	—	16·6	17·6	18·3	17·5

* Results for two years only.

Table XII.

TRIALS AT SELBY, 1933-35.

YIELD OF SUGAR AND VALUE PER ACRE.

The strains are given in the order of their value per acre.

Strain	Yield of sugar as percentage of control				Averages for 1933-1935			
	1933	1934	1935	1933-1935	Weight of washed beet	Sugar content	Price per ton at factory	Value of roots per acre
					Tons per acre	Per cent.	s. d.	£ s. d.
Kleinwanzleben E (control)	100	100	100	100	13·25	17·5	41 0	27 3 3
Dobrovice N	94	93	112	99·7	12·73	18·0	42 3	26 17 10
*Johnson's Perfection	—	99	109	(104·0)	(12·54)	(18·1)	(42 6)	(26 12 11)
Marsters	92	101	102	98·3	12·67	17·9	42 0	26 12 2
Kuhn P	86	103	105	98·0	12·27	18·3	43 0	26 7 7
Kleinwanzleben N	91	96	100	95·7	12·71	17·4	40 9	25 18 0
Dippe W.I.	92	90	94	92·0	12·12	17·6	41 3	25 0 0
Yield of sugar in tons per acre from Kleinwanzleben E	2·55	2·37	2·01	2·31	—	—	—	—

* Results for two years only.

Table XIII.

SUPPLEMENTARY SUGAR BEET TRIALS, 1933-35.

PERCENTAGE OF BOLTERS.

The strains are arranged in the order of the general average percentage of bolters.

Strain	Cannington			Newport			Sprowston			Good Easter		Harswell	General average
	1933	1934	1935	1933	1934	1935	1933	1934	1935	1933	1934	1935	
Kleinwanzleben E (control) ...	0·00	0·00	0·02	No bolters	0·05	No bolters	0·39	0·76	0·56	0·06	0·57	0·25	0·22
Glostrup B ...	0·00	0·00	0·17		0·05		0·61	0·32	0·52	0·03	0·50	0·71	0·24
Danish 31-IV ...	0·03	0·13	0·24		0·24		1·77	2·54	0·60	0·03	0·14	1·46	0·60
Delitzscher E ...	0·00	0·03	0·37		0·08		2·56	2·46	2·21	0·03	0·26	2·41	0·87
Schmidt A ...	0·06	0·03	0·44		0·03		2·31	2·12	2·56	0·03	0·32	2·73	0·89
Average of all strains ...	0·02	0·04	0·25		0·09		1·53	1·64	1·29	0·04	0·36	1·51	0·56

Table XIV.

SUPPLEMENTARY SUGAR BEET TRIALS, 1933-35.

NUMBER OF ROOTS PER ACRE EXPRESSED AS A PERCENTAGE OF KLEINWANZLEBEN E.

The strains are arranged in the order of the general average number of roots per acre.

Strain	Cannington			Newport			Sprowston			Good Easter		Harswell	General average
	1933	1934	1935	1933	1934	1935	1933	1934	1935	1933	1934 (a)	1935	
Glostrup B ...	112	102	100	103	102	95	99	102	101	102	[105]	104	102·0
Danish 31-IV ...	101	101	103	96	101	99	97	101	104	103	[108]	99	100·5
Kleinwanzleben E (control) ...	100	100	100	100	100	100	100	100	100	100	[100]	100	100·0
Delitzscher E ...	104	101	102	103	102	73	98	94	106	104	[103]	101	98·9
Schmidt A ...	100	101	91	94	102	83	98	100	84	96	[107]	94	94·8
Number of roots per acre of Kleinwanzleben E ...	28,568	30,304	32,248	39,280	33,129	29,960	29,560	24,224	24,296	27,888	[21,168]	28,240	29,518

(a) Included for record only; excluded from all averages. See text, p. 105.

Table XV.

SUPPLEMENTARY SUGAR BEET TRIALS, 1933-35.

WEIGHT OF INDIVIDUAL ROOTS EXPRESSED AS A PERCENTAGE OF KLEINWANZLEBEN E.

The strains are arranged in the order of their general average root weights.

Strain	Cannington			Newport			Sprowston			Good Easter		Harswell	General average
	1933	1934	1935	1933	1934	1935	1933	1934	1935	1933	1934 (a)	1935	
Schmidt A ...	101	97	107	94	95	115	99	101	100	99	[96]	99	100·6
Kleinwanzleben E (control) ...	100	100	100	100	100	100	100	100	100	100	[100]	100	100·0
Delitzscher E ...	95	89	93	93	87	107	91	91	91	89	[104]	89	92·3
Glostrup B ..	93	93	97	87	90	92	89	92	93	86	[101]	89	91·0
Danish 31-IV ..	93	88	90	83	84	90	86	81	88	90	[100]	94	87·9
Average weight of Kleinwanzleben E roots, lb. ...	0·75	1·31	0·99	0·54	1·32	0·97	1·39	1·56	1·40	0·99	[1·34]	1·60	1·165

(a) Included for record only; excluded from all averages. See text, p. 105.

Table XVI.

SUPPLEMENTARY SUGAR BEET TRIALS, 1933-35.

YIELDS OF WASHED ROOTS PER ACRE EXPRESSED AS A PERCENTAGE OF KLEINWANZLEBEN E.

The strains are arranged in the order of their general average yields.

Strain	Cannington				Newport				Sprowston				Good Easter		Harswell	General average
	1933	1934	1935	1933–1935	1933	1934	1935	1933–1935	1933	1934	1935	1933–1935	1933	1934 (a)	1935	
Kleinwanzleben E (control) ...	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	[100]	100·0	100·0
Schmidt A ...	102	98	98	99·3	89	97	96	94·0	97	101	83	93·7	95	[102]	93	95·4
Glostrup B ...	104	96	97	99·0	88	92	87	89·0	87	94	93	91·3	88	[106]	93	92·6
Delitzcher E ...	98	90	95	94·3	94	88	78	86·7	89	86	97	90·7	92	[108]	91	90·7
Danish 31-IV ...	94	89	93	92·0	79	85	88	84·0	84	82	92	86·0	92	[108]	93	88·3
Significant difference = ± per cent. of control...	8·13	3·30	4·10	—	5·79	3·15	6·50	—	4·32	6·67	9·20	—	5·49	(b)	5·55	—
Yield of Kleinwanzleben E in tons per acre ...	9·59	17·75	14·23	13·86	9·55	19·55	13·03	14·04	16·43	16·89	15·18	16·17	12·34	[12·66]	20·14	14·97

(a) Included for record only; excluded from all averages. See text, p. 105.

(b) In these trials none of the differences in yield was significant.

Table XVII.

SUPPLEMENTARY SUGAR BEET TRIALS, 1933-35.

SUGAR CONTENT OF ROOTS EXPRESSED AS A PERCENTAGE OF KLEINWANZLEBEN E.

The strains are arranged in the order of their general average sugar content.

Strain	Cannington				Newport				Sprowston				Good Easter		Harswell	General average
	1933	1934	1935	1933-1935	1933	1934	1935	1933-1935	1933	1934	1935	1933-1935	1933	1934 (a)	1935	
Danish 31-IV ...	106·1	109·1	101·3	105·5	102·5	105·8	102·5	103·6	104·4	103·8	103·1	103·8	102·7	[103·5]	104·3	104·1
Delitzcher E ...	104·3	104·9	100·0	103·1	101·5	104·1	101·3	102·3	102·2	101·3	100·6	101·4	100·9	[101·5]	104·9	102·4
Kleinwanzleben E (control) ...	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	[100·0]	100·0	100·0
Glostrup B ...	101·8	98·8	98·1	99·6	102·2	103·5	98·8	101·5	101·9	97·5	97·5	99·0	98·4	[101·0]	101·2	100·0
Schmidt A ...	101·5	102·4	96·8	100·2	96·5	102·3	97·5	98·8	97·5	99·4	99·4	98·8	99·1	[100·0]	101·2	99·4
Percentage of sugar in Kleinwanzleben E ...	16·3	16·4	15·4	16·0	15·8	17·1	16·0	16·3	15·9	15·9	16·1	16·0	16·3	[19·8]	16·4	16·2

(a) Included for record only; excluded from all averages. See text, p. 105.

Table XVIII.

SUPPLEMENTARY SUGAR BEET TRIALS, 1933-35.

YIELD OF SUGAR PER ACRE EXPRESSED AS A PERCENTAGE OF KLEINWANZLEBEN E.

The strains are arranged in the order of their general average sugar yields.

Strain	Cannington				Newport				Sprowston				Good Easter		Harswell	General average
	1933	1934	1935	1933–1935	1933	1934	1935	1932–1935	1933	1934	1935	1933–1935	1933	1934 (a)	1935	
Kleinwanzleben E (control) ...	100	100	100	100·0	100	100	100	100·0	100	100	100	100·0	100	[100]	100	100·0
Schmidt A ...	104	100	95	99·7	86	99	93	92·7	94	100	83	92·3	94	[102]	94	94·7
Delitzcher E ...	103	94	95	97·3	96	92	80	89·3	90	87	97	91·3	93	[110]	95	92·9
Glostrup B ...	106	95	95	98·7	90	96	86	90·7	89	91	91	90·3	86	[107]	94	92·6
Danish 31-IV ...	100	97	94	97·0	81	90	91	87·3	88	85	95	89·3	95	[112]	98	92·2
Yield of sugar in tons per acre from Kleinwanzleben E ...	1·56	2·91	2·19	2·22	1·51	3·34	2·08	2·31	2·62	2·69	2·44	2·58	2·02	[2·51]	3·30	2·423

(a) Included for record only; excluded from all averages. See text, p. 105.

Table XIX.

SUPPLEMENTARY SUGAR BEET TRIALS, 1933-35.

GENERAL AVERAGE VALUE OF BEETS PER ACRE.

The strains are arranged in the order of their value per acre.

Strain	Average weight of washed beets	Average sugar content	Average price per ton at factory	Average value of roots per acre	Average value as per cent of Klein. E.
	Tons per acre	Per cent.	s. d.	£ s. d.	Per cent.
Kleinwanzleben E (control) ...	14·97	16·2	37 9	28 5 1	100
Schmidt A	14·28	16·1	37 6	26 15 6	95
Glostrup B	13·85	16·2	37 9	26 2 10	93
Delitzscher E	13·51	16·5	38 6	26 0 1	92
Danish 31-IV	13·20	16·8	39 3	25 18 1	92

* The results from the 1934 Good Easter trials are excluded from the averages in this table; See text, p. 105.

Table XX.

SUGAR BEET TRIAL ON FEN LAND, LITTLEPORT, 1935.

Strain	Yield of washed roots		Sugar content	Yield of sugar		Average root weight		Number of roots		Percentage of bolters
	Tons per acre	Per cent.	Per cent.	Tons per acre	Per cent.	lb.	Per cent.	Per acre	Per cent.	
Marster's British Hilleshog (control)	19·83	100	15·3	3·03	100	1·86	100	23,884	100	Nil
Kuhn E	18·72	94	15·5	2·90	96	1·68	90	24,920	104	Nil
Dobrovice N ...	18·64	94	15·2	2·83	94	1·98	106	21,080	88	Trace

Significant yield difference=3·2 per cent. yield of the control.

SPRING OAT TRIALS, 1932 — 1935.

E. G. THOMPSON, M.A.

Previous trials reported in this Journal amply proved the merit of the Swedish oats, Victory, Star and Golden Rain I and II. Of these, Victory had become widely known and grown by farmers and it was decided that this oat should be used as the control variety in the 1932 and subsequent trials. All the trials, therefore, were carried out on the Beaven's half-drill strip system and, with one exception, with Victory as control. It is interesting to note in this connection that five of the varieties tested, each coming from a different source, had Victory as one parent.

The varieties tested during the period were as follows :—

Marvellous. Messrs. Gartons' well-known oat which had previously been tested as a winter oat but had not had thorough trial as a spring oat.

236/5 and 236/29. Selections from a cross between Victory and Black Potato produced by Dr. Hunter of the Cambridge Plant Breeding Institute.

S.84. A cross between Victory and Red Algerian produced by the Welsh Plant Breeding Station.

Eagle. A cross between Victory and von Lockow's Yellow Oat produced by the Svalof Plant Breeding Institute, Sweden.

Resistance. Dr. Hunter's cross between Grey Winter and Argentine, which had been tested as a winter oat but not as a spring oat.

Progress. A cross between Victory and Supreme produced by Messrs. Gartons Ltd.

Glasnevin Success No. 3. A cross between Victory and Record produced by the Albert Agricultural College, Glasnevin, Dublin.

Glasnevin Sonas. A cross between Banner and Black Tartary produced by the Albert Agricultural College, Glasnevin.

Onward. A cross between Marvellous and Superb produced by Messrs. Gartons Ltd.

Potato. A pure line selection from Messrs. McGill & Smith. Tested at Cannington in 1933 only.

The trials were carried out at the Institute's normal stations, which included Good Easter, Essex, up to 1934 only, this station being replaced by Askham Bryan, Yorkshire, in 1935. In addition, through the kindness of several authorities trials were carried out in 1933 and 1934 at Cockle Park and Walwick, Northumberland, at the Herts. Institute of Agriculture, Oaklands, St. Albans, at Kirton Farm Institute, Lincolnshire, and at the Potato Testing Station, Ormskirk, Lancashire. Trials of S.84 were continued in 1936 and, since the results of these are available, they have been included in this report in order to complete the data concerning this variety.

The particulars of the soils, previous cropping and manuring at these centres are given in Table I. Seed of all varieties was dusted with a mercury compound dressing before sowing.

1932 trials.

Marvellous and 236/5 were tested at all centres and S.84 at four centres in 1932, while Glasnevin Sonas, which had been tried at several stations in 1931, was continued at Cannington only. The season was normal and sowing took place between the 17th February and the 15th March. Growth was good at all centres and heavy crops were obtained without serious trouble from pests or diseases. Some lodging occurred at Cannington, Long Sutton and Newport, but this was not serious.

1933 trials.

The trials of 236/5 were discontinued, but four new varieties were introduced at all centres in this season. These were Eagle, Progress, Glasnevin Success No. 3 and Resistance (136/17), and since Resistance was a winter oat an additional trial was sown at Cambridge a month later than normal in order to test its behaviour under these conditions. Glasnevin Sonas was repeated at Cannington only, and at this centre there was also a trial of Pure Line Potato oats. Trials of Resistance were carried out at Walwick and Oaklands and a trial of S.84 at Ormskirk.

Owing to a wet period sowing took place in February only at Cambridge and Oaklands. Most of the other centres drilled between the 10th and 24th March, although Walwick was not able to drill until the 5th April. The season was not very favourable to spring oats. A very dry period occurred during the second half of May and early June, and another hot dry period occurred at harvest time. As a consequence, although growth was satisfactory and free from disease, ripening was premature in many cases and there was no severe test of straw strength. Some lodging occurred at Newport and a little at Good Easter and Long Sutton, but none at Cambridge, Cannington or Sprowston.

1934 trials.

The trials of Marvellous were discontinued in 1934 except that the variety was used as control to Resistance on the fen soil at Kirton. Progress, which had done poorly in 1933, was continued only at Cannington. The trials of Glasnevin Sonas and Potato at Cannington were not continued.

Conditions in the spring were favourable for early sowing, and all the trials were sown between the 12th and 22nd February. Once again the general growth was satisfactory during the early stages, but suffered from drought during June and July. Ripening was again premature in many cases, and there was even less test of straw strength than in 1933. It was noted at Newport that the short uniform straw of Resistance produced sheaves which held the rain in a wet harvest.

1935 trials.

The new variety Onward was tested at all centres in this season and the variety Progress, grown only at Cannington in 1934, was discontinued.

Sowing was rather later than in 1934 but all the trials were sown between the 19th February (Cannington) and the 21st March (Long Sutton).

For the third year in succession drought came during the later stages of growth and rushed the ripening period. Conditions were fairly normal up to the middle of June and quite satisfactory crops were obtained with very little disease. Weeds were a little troublesome and the trials at Askham Bryan were sprayed with sulphuric acid, while at Cannington it was noted that the more prostrate habit and slower " shooting " of S.84 and Resistance favoured weed growth in plots of these varieties. There was very little lodging and no serious test of straw strength.

1936 trials.

It was considered that the variety S.84, a late maturing variety with strong straw, had not received a fair trial in three dry seasons with little test of straw strength. The trials were therefore continued in 1936, together with other trials not reported here. Fortunately the season was favourable in the sense that it was wet, but in spite of this there was only slight lodging. Harvest was late, however, and there was every chance for the grain to develop normally. In many cases, and particularly in S.84, the straw actually remained green long after the grain was ripe and hard.

FIELD CHARACTERISTICS OF THE VARIETIES.

Tillering and early growth.

All the varieties were erect in their early growth except Resistance and S.84. Resistance was intermediate in habit and more free tillering than the erect types. S.84, while not erect, was not as prostrate as Resistance. It was not possible to distinguish any constant differences in tillering power between the varieties except in the case of Resistance.

Resistance to disease, etc.

Very little disease occurred and pests did only small damage, being chiefly confined to wireworm and, of course, frit fly. No difference in resistance to these troubles was observed or expected. A certain amount of rust was observed at Cannington, mainly in 1935, and here it was considered that S.84 was definitely more susceptible than the other varieties and Onward slightly more susceptible. Another feature noted about S.84 was that it showed a far greater number of sterile spikelets than the other varieties.

Time of maturity.

In spite of the rapid premature ripening in several seasons, there were considerable differences in the time of maturity. Victory the control was rather later than Abundance previously used for this purpose, but compared with Victory the varieties ripened as follows :—

Marvellous	3 days earlier
Onward	2 ,, ,,
Glasnevin Success No. 3	1 day ,,
Victory	equal
Progress	equal
236/5	equal
Eagle	1 day later
Resistance	2 days ,,
S.84	3 ,, ,,
Glasnevin Sonas ...	5 ,, ,,

Straw.

The length of straw did not vary so greatly but it was noticeable that nearly all the varieties had slightly shorter straw than Victory. Several of the varieties, particularly Resistance, had a more uniform length of straw than did Victory, which showed a moderate amount of fluctuation. As mentioned elsewhere, extreme levelness of straw height is not always considered an advantage, particularly in the wetter districts. The average differences between the varieties and Victory were as follows :—

Glasnevin Sonas ...	1 inch more
Victory	equal
236/5	equal
Progress	equal
Eagle	2 - 3 inches less
Marvellous	2 - 3 inches less
Glasnevin Success No. 3	3 inches less
Onward	3 inches less
S.84	3 inches less
Resistance	7 inches less

The thickness of the straw is difficult to compare accurately in field crops, but it was generally considered by the Recorders that Marvellous, 236/5, S.84, Glasnevin Sonas and Onward had stouter straw than Victory. Progress and Glasnevin Success No. 3 were similar to Victory, while Eagle and Resistance were similar to or slightly thinner than Victory.

The difference in standing power was not very marked, partly owing to weather conditions but also owing to the marked improvement in this respect in the newer varieties. Victory itself is much stronger than Abundance, previously used as control, but nearly all the varieties in this series of trials were superior to Victory; none was worse than Victory. Exact comparison is more difficult than it appears since, with a fairly wide difference in the time of maturity, the extent of lodging depends a good deal on the stage reached when the storm occurs, and it is no impossible thing for a variety to stand better than its control at one station and worse at another station.

The average order of resistance to lodging was as follows :—

Resistance	most resistant
S.84	
Glasnevin Sonas	
Marvellous }	
Eagle }	
Glasnevin Success No. 3	
Progress }	
236/5 }	least resistant
Victory }	

Marvellous and Resistance had straw which broke fairly readily when over-ripe. The position of Onward was doubtful, and since trials of that variety are being continued it has been omitted from the list.

The yield of straw is given in Table VIII. The figures have not the same degree of accuracy as those for grain, but while in the past it has been the practice to give threshed weights for straw, it is almost certainly more

accurate to assume that the moisture content of the straw approximates to that of the grain after the two have been in the stack some time. The straw figures have therefore been calculated as dry weight on this assumption.

GRAIN.

Feeding value and market value.

The Institute is again indebted to Mr. C. J. Mapey for undertaking to value the grain from the trials year by year. The actual values are set out in Table X. The feeding value judged by the percentage of husk is set out in Table IX.

Since these are obviously important and since they do not agree in the placing of the varieties they have been combined with the yield Tables VII and VIII to form the summary of yields in Table XI. Although the figures for Onward are not final since the variety is still in trials, they have been included in this table because they are an extreme case of the tendency referred to in previous reports, for the feeding value and market value to move independently of one another and often even in opposite directions. The market preference for a large white plump grain exists. Oats are bought for feeding horses and poultry, etc., but also for milling, and exactly how far the existing preference is justified it is impossible to say, but judging from the proportion of husk there is no justification from the feeding point of view.

In the present series of trials Eagle had the highest proportion of kernel but nearly the lowest valuation. Onward with 5 per cent. less kernel was valued about 8 per cent. higher. Such a large difference makes it very necessary that the grower should make up his mind whether he is growing for the market or for his own use.

CONSIDERATION OF THE VARIETIES.

Glasnevin Sonas.

This variety had strong straw but the yield of grain was not significantly higher than that of Victory and the quality of the grain was poorer. The variety was also very late in maturing, and in view of other oats with equally strong straw there is no object in growing this oat in the area covered by these trials.

236/5 and Progress.

Similar in date of maturity and straw length to Victory, both these oats failed to give a yield of grain anywhere approaching that of Victory, and in the absence of any other compensating characters they cannot be recommended. The fact that 236/5 gave a higher yield of straw does not invalidate this statement.

236/29.

Rather similar in type to S.84, it gave more straw than that variety but much less grain.

S.84.

The outstanding feature of this oat was its straw, which was stouter and shorter than that of Victory and stood better. The variety was late maturing and the yield of grain did not quite equal that of Victory and was

more husky. It was considered that the dry seasons were against it, but even in the wet season of 1936 it failed to show any marked advantages over Victory, save standing power. and this was also shown by other varieties already on the market.

Marvellous and Resistance.

These two varieties are both normally sown in the autumn or very early spring, but since " very early spring " easily becomes " spring " and even " late spring ", information was desired as to their behaviour as normal spring oats. They were not much alike, Marvellous being early and having stout straw of fairly normal length, while Resistance was rather later than Victory and had thin but very short straw. Both stood better than Victory, but Resistance had the advantage over Marvellous in this respect and also in yield of grain, although the grain of Marvellous was valued higher.

The trials showed that both varieties can be sown as spring oats with success, but while they both have special value where serious lodging is expected, preference should be given to other varieties on normal soils at normal spring sowing times.

Eagle.

A little later than Victory with rather shorter and stronger straw, this variety gave a higher yield of grain and only slightly less straw. The grain was slightly less husky but, owing to its being rather smaller, was valued lower. For every purpose except sale on the market this oat can be strongly recommended. Even for sale it gave better results than Victory, but in view of what has been said about market value, if oats are grown purely for sale it would probably pay the farmer to grow a coarser but more marketable variety.

Glasnevin Success No. 3.

This variety was similar to Victory in some respects but ripened a little earlier and had shorter straw less liable to lodging. The yield of grain was slightly higher than Victory, but being a little more husky it showed little advantage over Victory in yield of kernel. On the other hand it was valued rather higher. In view of the smaller yield of straw and about equal yield of kernel there is no reason for preferring this variety from the feeding point of view, and if grown for sale it would seem that Onward should be preferred.

Onward.

This variety is still in trials and therefore any statement must be made with that proviso. It would appear however to be the most profitable oat to grow for sale, giving high yields of grain, which although thick husked, is favoured on the market.

Table I.

SPRING OAT TRIALS, 1932 - 1935.

Summary of soils with height above sea level, manuring and previous cropping.
Weights all in cwt. per acre unless otherwise stated.

Season	Cambridge	Good Easter	Cannington.	Long Sutton	Newport	Sprowston.	Ormskirk.	Walwick.	Oaklands.
1932	**Light gravelly loam.** **90 ft.** **2 Super.** **1 30% Potash Salts.** **1 Nitro-Chalk** **Peas.**	Heavy clay. 195 ft. 5 Super. 2 Nitrate of Soda. Wheat. Heavy clay.	Silty loam. 40 - 70 ft. 8 tons dung. Barley and Wheat.	Heavy stony loam. 420 ft. 1½ Super 1 Sulphate of Ammonia. Wheat.	Sandy loam. 210 ft. 2½ Super. ½ Muriate of Potash. 1 Sulphate of Ammonia. Wheat and Oats.	Light loam. 100 ft. 4 complete mixture. Wheat and Oats.			
1933	**Light gravelly loam.** **90 ft.** **3 Super.** **2 30% Potash Salts.** **1½ Nitro-Chalk** **Winter oats.**	190 ft. 4 Super. 1 Nitrate of Soda. Barley.	Silty loam. 25 - 30 ft. No manure. Roots.	Clay loam over chalk. 445 ft. No manure. Mangolds.	Sandy loam. 210 ft. 4 mixture. Wheat.	Free working light loam. 93 ft. Sugar beet tops ploughed in. Sugar beet.	Black sandy loam. No manure. Roots.	Boulder clay. over limestone. 500 ft. No manure. Long ley.	Gravelly clay. 300 ft. 3 complete mixture. Winter oats.
1934	Medium loam. 80 ft. 12 tons dung. 3 cwt. Super 1½ 30% Potash Salts. Wheat.	Heavy clay. 190 ft. 4 Super. 1 Sulphate of Ammonia. Wheat.	Silty loam. 40 - 50 ft. No manure. Sugar beet.	Medium loam. 460 ft. 2 Super. 1 Sulphate of Ammonia. 1½ 30% Potash Salts. Wheat.	Sandy loam. 205 - 210 ft. No manure. Mangolds.	Free working loam. 100 ft. Half sugar beet tops ploughed in. Sugar beet.			Clay loam with some gravel. 300 ft. No manure. Permanent grass.
1935	Heavy clay. 80 ft. 3 Super. 1 30% Potash Salts. 1½ Nitro-Chalk Wheat.	**Askham Bryan** Sandy loam. 72 ft. 2 Super. 1½ 30% Potash Salts. 1 steamed bone flour. 1 Sulphate of Ammonia. Wheat.	Silty loam. 40 - 70 ft. No manure. Sugar beet.	Heavy stony loam. 480 ft. 1½ Super. 1½ 30% Potash Salts. 1 Sulphate of Ammonia. Clover.	Sandy loam. 220 ft. Aftermath grazed by sheep and ploughed in. Seeds.	Free working loam. 100 ft. 3 Super. 1 Muriate of Potash. 1 Sulphate of Ammonia. Wheat.			

Table II.

YIELD OF SPRING OATS, 1932.

Significant yield differences are printed in heavier type.

Station and yield per acre of control variety threshed weight	Name of variety	Yield of grain as percentage of control dry weight	Difference from control	Standard error	Yield of straw as percentage of control threshed weight
CAMBRIDGE.	Marvellous	94	**− 6**	1·71	87
Victory	236/5	88	**−12**	1·37	105
Average yield per acre, 33·2 cwt.					
GOOD EASTER.	Marvellous	*102	+ 2	2·67	101
Victory	236/5	104	+ 4	2·09	114
Average yield per acre, 29·1 cwt.	S.84	*103	+ 3	3·55	102
CANNINGTON.	Marvellous	98	− 2	2·12	68
Victory	236/5	92	**− 8**	1·89	125
Average yield per acre, 32·6 cwt.	S.84	106	**+ 6**	2·41	122
	Glasnevin Sonas	107	**+ 7**	1·83	112
LONG SUTTON.	Marvellous	97	− 3	3·68	110
Victory	236/5	99	− 1	5·29	102
Average yield per acre, 26·4 cwt.					
NEWPORT.	Marvellous	98	− 2	0·76	94
Victory	236/5	86	**−14**	2·18	93
Average yield per acre, 32·5 cwt.	S.84	102	+ 2	1·11	108
SPROWSTON.	Marvellous	83	**−17**	3·99	87
Victory	236/5	88	**−12**	1·63	121
Average yield per acre, 32·6 cwt.	S.84	102	+ 2	2·20	111

* Threshed weight not dry weight.

Table III. YIELD OF SPRING OATS, 1933.

Significant yield differences are printed in heavier type.

Station and yield per acre of control variety threshed weight	Name of variety	Yield of grain as percentage of control dry weight	Difference from control	Standard error	Yield of straw as percentage of control threshed weight
CAMBRIDGE.	Marvellous	82	**−18**	3·22	92
Victory	S.84	96	**− 4**	1·28	94
Average yield per acre,	136/17 (early sowing)	106	**+ 6**	1·46	75
25·5 cwt.	136/17 (late sowing)	104	**+ 4**	1·28	71
	Eagle	110	**+10**	1·14	91
	Progress	91	**− 9**	1·04	98
	Glasnevin Success No.3	92	**− 8**	1·38	82
GOOD EASTER.	Marvellous	103	**+ 3**	1·53	105
Victory	S.84	89	**−11**	1·10	99
Average yield per acre,	136/17	99	− 1	1·11	98
34·8 cwt.	Eagle	106	**+ 6**	1·31	85
	Progress	90	**−10**	2·54	88
	Glasnevin Success No.3	106	**+ 6**	1·47	88
CANNINGTON.	Marvellous	104	**+ 4**	1·10	79
Victory	S.84	106	**+ 6**	1·59	101
Average yield per acre,	136/17	104	**+ 4**	1·29	93
31·8 cwt.	Eagle	110	**+10**	0·61	117
	Progress	99	− 1	1·50	104
	Glasnevin Success No.3	111	**+11**	1·02	87
	Glasnevin Sonas	101	+ 1	1·71	99
	Potato	90	**−10**	1·43	110
LONG SUTTON.	Marvellous	100	—	1·86	68
Victory	S.84	100	—	2·05	127
Average yield per acre,	136/17	99	− 1	2·17	85
28·6 cwt.	Eagle	108	**+ 8**	1·48	102
	Progress	91	**− 9**	1·78	112
	Glasnevin Success No.3	96	**− 4**	1·69	87
NEWPORT.	Marvellous	92	**− 8**	2·48	79
Victory	S.84	101	+ 1	2·61	110
Average yield per acre,	136/17	101	+ 1	2·32	78
29·2 cwt.	Eagle	109	**+ 9**	3·03	99
	Progress	91	**− 9**	2·54	89
	Glasnevin Success No.3	101	+ 1	2·14	89
SPROWSTON.	Marvellous	103	+ 3	3·65	69
Victory	S.84	96	**− 4**	1·01	96
Average yield per acre,	136/17	103	+ 3	1·66	86
28·7 cwt.	Eagle	105	+ 5	2·52	93
	Progress	87	**−13**	2·79	95
	Glasnevin Success No.3	109	**+ 9**	3·89	79
ORMSKIRK. Victory Average yield per acre, 30·8 cwt.	S.84	111	**+11**	2·27	106
S.84, 34·6 cwt.	236/29	78	**−22**	2·48	112
WALWICK. Victory Average yield per acre, 24 cwt.	136/17	90	**−10**	1·71	—
OAKLANDS. Victory Average yield per acre, 17·5 cwt.	136/17	102	+ 2	3·37	88

136/17 was later marketed as Resistance.

Table IV.

YIELD OF SPRING OATS, 1934.

Significant yield differences are printed in heavier type.

Station and yield per acre of control variety threshed weight	Name of variety	Yield of grain as percentage of control dry weight	Difference from control	Standard error	Yield of straw as percentage of control threshed weight
CAMBRIDGE. Victory Average yield per acre, 23·9 cwt.	S.84	93	**- 7**	1·87	—
	136/17	97	**- 3**	1·34	76
	136/17 (late sown)	92	- 8	4·04	85
	Eagle	110	**+10**	2·57	102
	Glasnevin Success No. 3	100	—	2·81	84
GOOD EASTER. Victory Average yield per acre, 27·7 cwt.	S.84	89	**-11**	3·77	98
	136/17	101	+ 1	1·93	83
	Eagle	106	**+ 6**	1·51	95
	Glasnevin Success No. 3	101	+ 1	1·77	82
CANNINGTON. Victory Average yield per acre, 34·8 cwt.	S.84	90	**-10**	1·82	100
	136/17	113	**+13**	1·26	95
	Eagle	114	**+14**	0·92	91
	Glasnevin Success No. 3	105	**+ 5**	0·89	86
	Progress	94	**- 6**	1·00	100
LONG SUTTON. Victory Average yield per acre, 27·7 cwt.	S.84	98	- 2	2·83	105
	136/17	104	**+ 4**	0·78	82
	Eagle	110	**+10**	1·35	103
	Glasnevin Success No. 3	109	**+ 9**	1·85	90
NEWPORT. Victory Average yield per acre, 33·9 cwt.	S.84	87	**-13**	4·37	98
	136/17	93	**- 7**	2·13	85
	Eagle	102	+ 2	2·29	94
	Glasnevin Success No. 3	97	**- 3**	1·86	82
SPROWSTON. Victory Average yield per acre, 21·8 cwt.	S.84	90	**-10**	3·77	98
	136/17	96	**- 4**	2·23	91
	Eagle	110	**+10**	2·54	124
	Glasnevin Success No. 3	102	**+ 2**	2·62	92
KIRTON. Marvellous Average yield per acre, 40·9 cwt.	136/17	112	**+12**	4·02	145
OAKLANDS. Victory Average yield per acre, 29·4 cwt.	136/17	82	**-18**	3·07	79
COCKLE PARK. Victory Average yield per acre, 20·5 cwt.	136/17	93	- 7	12·43	82

136/17 was later marketed as Resistance.

Table V.

YIELD OF SPRING OATS, 1935.

Significant yield differences are printed in heavier type.

Station and yield per acre of control variety threshed weight	Name of variety	Yield of grain as percentage of control dry weight	Difference from control	Standard error	Yield of straw as percentage of control threshed weight
CAMBRIDGE.	S.84	99	− 1	1·62	135
Victory	Resistance	113	**+13**	2·02	98
Average yield per acre,	Eagle	110	**+10**	1·77	77
23·7 cwt.	Glasnevin Success No. 3	109	**+ 9**	2·04	94
	Onward	119	**+19**	2·04	93
CANNINGTON.	S.84	101	+ 1	2·83	107
Victory	Resistance	96	− 4	1·43	82
Average yield per acre,	Eagle	103	+ 3	3·16	99
22·4 cwt.	Glasnevin Success No. 3	100	—	2·83	88
	Onward	110	**+10**	1·71	81
LONG SUTTON.	S.84	94	**− 6**	2·48	88
Victory	Resistance	94	− 6	3·46	104
Average yield per acre,	Eagle	99	− 1	1·39	81
20·0 cwt.	Glasnevin Success No. 3	107	**+ 7**	1·55	96
	Onward	103	**+ 3**	1·30	87
NEWPORT.	S.84	99	− 1	1·12	102
Victory	Resistance	100	—	1·35	91
Average yield per acre,	Eagle	102	+ 2	1·62	95
26·4 cwt.	Glasnevin Success No. 3	106	**+ 6**	1·78	88
	Onward	103	**+ 3**	1·18	87
SPROWSTON.	S.84	107	+ 7	3·35	98
Victory	Resistance	96	− 4	2·08	73
Average yield per acre,	Eagle	111	**+11**	1·58	103
23·4 cwt.	Glasnevin Success No. 3	105	**+ 5**	1·34	80
	Onward	110	**+10**	2·22	81
ASKHAM BRYAN.	S.84	94	− 6	4·67	110
Victory	Resistance	97	**− 3**	2·99	95
Average yield per acre,	Eagle	101	+ 1	4·41	86
27·9 cwt.	Glasnevin Success No. 3	104	+ 4	2·36	137
	Onward	107	**+ 7**	1·68	77

Table VI.

YIELD OF S.84 in 1936.

Significant yield differences are printed in heavier type.

Station and yield per acre of control variety threshed weight	Name of variety	Yield of grain as percentage of control dry weight	Difference from control	Standard error	Yield of straw as percentage of control threshed weight
CAMBRIDGE. Victory, 27·7 cwt.	S·84	102	+ 2	2·11	98
CANNINGTON. Victory, 21·4 cwt.	S·84	102	+ 2	1·22	102
LONG SUTTON. Victory, 14·3 cwt.	S·84	89	**−11**	2·51	114
NEWPORT. Victory, 27·9 cwt.	S·84	99	− 1	6·36	97
SPROWSTON. Victory, 19·3 cwt.	S·84	97	− 3	2·48	113
ASKHAM BRYAN. Victory, 14·2 cwt.	S·84	107	+ 7	3·44	103

Table VII.

AVERAGE YIELD OF SPRING OATS, 1932 - 1935.

Grain (dry weight).

The figures in brackets indicate the number of trial results included in the average. S.84 figures include 1936 results.

	Cambridge	Good Easter	Cannington	Long Sutton	Newport	Sprowston	Askham Bryan	Oaklands		General average
Eagle	110·0 (3)	106·0 (2)	109·0 (3)	105·7 (3)	104·3 (3)	108·7 (3)	101·0 (1)	—	—	107·0 (18)
Glasnevin Success No. 3	100·3 (3)	103·5 (2)	105·3 (3)	104·0 (3)	101·3 (3)	105·3 (3)	104·0 (1)	—	—	103·3 (18)
Victory (control)	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0
Resistance (136/17) ...	105·3 (3)	100·0 (2)	104·3 (3)	99·0 (3)	98·0 (3)	98·3 (3)	97·0 (1)	92·0 (2)	Walwick 90·0 (1)	99·3 (21)
S.84	97·5 (4)	93·7 (3)	101·0 (5)	95·3 (4)	97·6 (5)	98·4 (5)	100·5 (2)	—	Ormskirk 111·0 (1)	98·2 (29)
Marvellous ...	88·0 (2)	102·5 (2)	101·0 (2)	98·5 (2)	95·0 (2)	93·0 (2)	—	—	—	96·3 (12)
236/5	88·0 (1)	104·0 (1)	92·0 (1)	99·0 (1)	86·0 (1)	88·0 (1)	—	—	—	92·8 (6)
Progress ...	91·0 (1)	90·0 (1)	96·5 (2)	91·0 (1)	91·0 (1)	87·0 (1)	—	—	—	91·9 (7)

Table VIII.

AVERAGE YIELD OF SPRING OATS, 1932 - 1935.

Straw (dry weight).

The figures in brackets indicate the number of trial results included in the average. S.84 figures include 1936 results.

	Cambridge	Good Easter	Cannington	Long Sutton	Newport	Sprowston	Askham Bryan	Oaklands	Ormskirk	General average
236/5	105·0 (1)	114·0 (1)	125·0 (1)	102·0 (1)	93·0 (1)	121·0 (1)	—	—	—	110·0 (6)
S.84	109·0 (3)	101·3 (3)	106·4 (5)	108·5 (4)	103·0 (5)	103·2 (5)	106·5 (2)	—	106·0 (1)	105·1 (28)
Victory (control)	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0
Progress ...	98·0 (1)	88·0 (1)	102·0 (2)	112·0 (1)	89·0 (1)	95·0 (1)	—	—	—	98·0 (7)
Eagle	90·0 (3)	90·0 (2)	102·3 (3)	95·3 (3)	96·0 (3)	106·7 (3)	86·0 (1)	—	—	96·5 (18)
Glasnevin Success No. 3	86·7 (3)	85·0 (2)	87·0 (3)	91·0 (3)	86·3 (3)	83·7 (3)	137·0 (1)	—	—	89·5 (18)
Resistance (136/17) ...	83·0 (3)	90·5 (2)	90·0 (3)	90·3 (3)	84·7 (3)	83·3 (3)	95·0 (1)	83·5 (2)	—	86·9 (20)
Marvellous ...	89·5 (2)	103·0 (2)	73·5 (2)	89·0 (2)	86·5 (2)	78·0 (2)	—	—	—	86·6 (12)

Table IX. HUSK AS A PERCENTAGE OF TOTAL GRAIN WEIGHT.

Each figure is the average percentage of husk of five samples each of 100 grains.

		Marvellous	Victory Control to Marvellous	236/5	Victory Control to 236/5	S·84	Victory Control to S·84	Resistance (136/17)	Victory Control to Resistance	Eagle	Victory Control to Eagle	Progress	Victory Control to Progress	Glasnevin Success No. 3	Victory Control to Glasnevin Success No. 3	Onward	Victory Control to Onward
1932.	Cambridge ...	28·1	26·1	25·3	26·0												
	Good Easter ...	28·1	26·6	24·9	26·6	27·5	26·4										
	Cannington ...	29·0	26·5	26·5	26·1	27·9	27·3										
	Long Sutton	27·6	25·8	26·6	27·5												
	Newport ...	27·7	25·1	25·5	25·3	26·6	25·0										
	Sprowston ...	30·2	26·8	26·7	27·1	29·6	27·2										
1933.	Cambridge ...	26·8	28·2			28·1	27·8	27·1	27·7	27·8	27·5	26·7	27·7	28·1	28·5		
	Good Easter ...	31·9	32·0			34·7	31·0	33·0	31·2	30·1	31·4	30·2	30·9	31·2	30·2		
	Cannington ...	29·1	27·5			30·9	28·1	30·2	28·1	27·3	27·6	27·0	27·1	28·9	28·2*		
	Long Sutton	31·6	29·9			33·0	30·0	27·9	28·4	27·4	28·6	29·1	28·9	30·5	28·8		
	Newport ...	28·7	26·5			28·7	26·1	28·2	26·4	26·0	26·5	26·6	26·3	28·0	26·1		
	Sprowston ...	29·0	29·1			30·2	28·2	29·5	29·2	28·7	28·5	28·8	28·3	29·6	28·0		
	Ormskirk ...					32·3	27·5										
	Walwick ...							27·3	24·8								
	Oaklands ...							31·4	29·2								
1934.	Cambridge ...					31·0	29·6	29·6	29·9	28·9	30·3			30·9	31·5		
	Good Easter ...					30·3	31·0	29·6	30·5	28·9	30·9			32·7	29·9		
	Cannington ...					29·6	27·6	29·6	29·1	27·4	27·9	27·7	28·2	30·6	28·1		
	Long Sutton					29·3	27·8	29·9	27·9	27·8	29·7			30·3	29·1		
	Newport ...					30·5	28·5	29·1	27·9	27·4	28·8			29·7	27·8		
	Sprowston ...					31·5	28·9	30·9	28·7	27·7	28·7			30·4	28·8		
	Oaklands ...							30·3	31·8								
1935.	Cambridge ...					30·3	28·6	30·5	28·2	28·0	29·1			30·8	29·0	34·3	29·0
	Cannington ...					30·8	28·1	31·0	27·7	27·4	27·6			28·0	27·3	31·8	28·5
	Long Sutton					29·7	26·9	29·4	26·4	26·0	26·7			28·5	27·1	32·0	27·3
	Newport ...					30·7	26·8	29·0	26·9	25·7	26·9			29·0	26·3	31·3	26·7
	Sprowston ...					30·6	27·1	28·3	27·5	26·4	27·1			29·2	27·6	30·0	27·2
	Askham Bryan					30·3	26·9	29·0	26·5	26·3	26·5			26·6	26·5	30·8	26·8
1936.	Cambridge ...					29·0	26·2										
	Cannington ...					30·6	26·4										
	Long Sutton					31·2	28·2										
	Newport ..					28·6	26·0										
	Sprowston ...					29·8	27·9										
	Askham Bryan					29·8	26·3										
	Average	29·0	27·5	25·9	26·1	30·1	27·7	29·6	28·3	27·5	28·3	28·0	28·2	29·6	28·3	31·7	27·6
	Equal to kernel ...	71·0	72·5	74·1	73·9	69·9	72·3	70·4	71·7	72·5	71·7	72·0	71·8	70·4	71·7	68·3	72·4
	Difference from control (Control=100)	−2·1		+0·3		−3·3		−1·8		+1·1		+0·3		−1·8		−5·7	

Cannington 1932. Glasnevin Sonas 27·5; Victory 27·1. 1933. Glasnevin Sonas 29·5; Victory 27·7; Potato 26·0; Victory 27·7.

Table X.

VALUATION OF THE GRAIN IN SHILLINGS PER 336 LB.

	Marvellous	Victory Control to Marvellous	236/5	Victory Control to 236/5	S.84	Victory Control to S·84	Resistance (136/17)	Victory Control to Resistance	Eagle	Victory Control to Eagle	Progress	Victory Control to Progress	Glasnevin Success No. 3	Victory Control to Glasnevin Success No.3	Onward	Victory Control to Onward
1932. Cambridge ...	21·0	20·0	21·0	21·0												
Good Easter ...	20·0	20·0	19·0	20·0	20·0	20·0										
Cannington ...	21·0	20·5	20·5	20·5	20·0	20·5										
Long Sutton	20·0	19·5	18·5	18·5												
Newport ..	20·0	18·0	20·0	20·0	18·5	19·0										
Sprowston ...	17·0	16·5	18·0	17·5	16·5	18·0										
1933. Cambridge ...	19·5	19·0			19·0	19·0	18·0	18·5	19·0	19·0	19·0	19·0	20·0	19·0		
Good Easter ...	19·0	18·5			19·0	19·0	18·0	18·5	18·0	18·5	19·0	18·0	18·0	19·0		
Cannington ...	19·0	18·0			19·0	19·0	18·5	19·0	18·0	19·0	19·5	19·0	19·0	19·0		
Long Sutton	18·0	18·5			19·5	19·0	18·5	19·0	18·5	19·0	18·5	19·0	18·5	19·0		
Newport ..	19·0	19·0			18·5	19·0	19·0	19·0	18·0	19·0	19·0	19·0	19·0	19·0		
Sprowston ...	18·5	19·0			18·0	19·0	17·5	19·0	18·0	18·5	18·5	19·0	19·0	18·5		
Ormskirk ...					21·0	20·0										
Walwick ...							19·0	20·0								
Oaklands ...							18·0	19·5								
1934. Cambridge ...					22·5	22·0	21·0	22·0	21·5	21·5			22·3	22·0		
Good Easter ...					22·0	22·3	21·0	22·0	21·5	22·0			22·0	22·0		
Cannington ...					22·0	22·5	22·0	22·5	22·0	22·5	23·0	22·5	22·5	22·0		
Long Sutton					22·0	21·5	21·0	22·5	21·0	22·0			21·5	22·0		
Newport ...					20·0	21·8	21·5	22·0	22·0	22·0			22·0	22·0		
Sprowston ...					22·0	22·0	21·0	21·5	22·0	22·0			22·0	22·5		
Oaklands ...							20·5	21·5								
1935. Cambridge ...					20·5	20·0	18·5	20·0	19·0	20·0			20·5	19·0	21·0	20·0
Cannington ...					21·5	20·0	19·5	22·0	20·0	21·0			22·0	21·0	21·5	20·0
Long Sutton					21·5	21·0	18·5	21·0	20·0	21·5			20·0	20·5	21·0	20·0
Newport ..					21·0	20·0	19·0	20·0	19·5	22·0			21·5	20·5	21·0	21·5
Sprowston ...					22·0	21·5	19·5	20·5	20·0	20·0			20·5	20·0	22·0	21·0
Askham Bryan					20·0	20·0	19·0	19·5	18·8	20·0			20·0	20·5	20·5	19·0
1936. Cambridge ...					24·0	24·0										
Cannington .					24·0	25·5										
Long Sutton					24·0	23·5										
Newport ...					22·5	23·5										
Sprowston ...					23·0	22·5										
Askham Bryan					23·5	23·0										
Average in shillings	19·3	18·9	19·5	19·6	20·9	21·0	19·5	20·5	19·8	20·5	19·5	19·4	20·6	20·4	21·2	20·3
As percentage of control	102·1		99·5		100·0		95·2		96·6		100·5		101·0		104·5	

Cannington, 1932. Glasnevin Sonas 9·0, Victory 19·5. 1933. Glasnevin Sonas 18·5, Victory 18·5; Potato 19·0, Victory 19·0.

Table XI.

SUMMARY OF YIELDS AS PERCENTAGE OF VICTORY.

	Yield of grain	Yield of kernel	Valuation of grain (Yield of money)	Yield of straw
	(1)	(2)	(3)	(4)
Eagle	107·0	108·2	103·3	96·5
Glasnevin Success No. 3 ...	103·3	101·4	104·3	89·5
Victory	100·0	100·0	100·0	100·0
Resistance	99·2	97·5	94·5	86·9
S.84	98·2	95·0	98·2	105·1
Marvellous	96·3	94·3	98·3	86·6
236/5	92·8	93·1	91·8	110·0
Progress	91·9	92·2	92·4	98·0
*Onward	108·7	102·5	113·6	84·3

* Onward is still under trial and the figures are therefore not final.

Column 2. " Yield of kernel " shows the feeding value of each variety compared with the control Victory. Column 3 shows the value of each variety for sale purposes, compared with the control. The marked differences between feeding value and sale value, to which attention has been drawn on p. 131, will be noted.

COUNTY SPRING OAT TRIALS, 1935.

B. BRANDRETH, B.A.

These trials, arranged jointly with agricultural education authorities, were held for the fifth successive season in 1935. The number of trials sown was 69, and this figure, together with the number of trials yielding useful results, was higher than in any of the three previous years.

The chief varieties, seed of which was grown and distributed by the Institute, were, as in 1934, Eagle, Golden Rain II, Progress and Star. A number of supplementary varieties was grown at sixteen of the centres, and these are commented on in due course.

From the 69 trials, complete results were obtained in only 29 cases, but figures relating to the yield of grain of the four chief varieties were returned by 56 centres. The crop at one centre failed, the results from five centres were not available in time for inclusion in this report (May 1936), and at the remaining centres Progress was not grown.

In all but two trials, the returns were from single plots.

YIELD OF GRAIN.

Tables I and II show the average total yields of grain in England and Wales and in the individual counties.

Table I.

Section	No. of trials	Average yield of grain (cwt. per acre)					
		Eagle	Golden Rain II	Progress	Star	S.E. of mean	Significant difference (P=0·05)
England							
All sections	44	23·03	22·03	20·19	22·97	0·44	1·27 (a)
Wales	12	20·69	21·38	19·71	20·55	—	—
England							
North	10	30·19	27·87	24·03	29·75	1·13	3·56 (b)
Midland	14	20·39	18·95	17·81	19·61	—	—
East	9	27·05	26·26	25·18	26·07	—	—
South	11	16·61	17·18	15·62	18·55	0·64	1·98 (c)

(a) and (b) Eagle, Star and Golden Rain II significantly outyield Progress.
(c) Star significantly outyields Progress.

In England as a whole, and in three of the major divisions, Eagle produced the heaviest yield, though its superiority to the other varieties did not in every case reach statistical significance.

In every district the difference between the yields of Eagle and Star was small, and in the southern counties Star outyielded Eagle by 8 per cent. The only significant differences, however, were between Progress and the other varieties, Progress having the lowest yield in every district. Golden

Rain II occupied an intermediate position between Progress and Star (or Eagle).

There was little difference between the yields of the four varieties in Wales. Golden Rain II was slightly better than Eagle or Star, which were similar, and all three outyielded Progress.

Table II.

County	No. of trials	Average yield of grain (cwt. per acre)			
		Eagle	Golden Rain II	Progress	Star
Berkshire	4 (a)	15·73	16·69	15·18	16·94
Devon	4	14·72	14·74	14·68	17·83
Gloucestershire	4	14·10	14·23	13·30	14·22
Leicestershire	4	21·13	19·87	19·67	22·17
Northumberland	4	34·83	31·35	25·60	34·71
Carmarthenshire	3	13·25	13·17	13·69	12·87
Pembrokeshire	3	13·36	16·39	16·31	16·09
Warwickshire	3	19·77	19·52	16·73	21·23
Bedfordshire	2	23·50	22·56	20·51	21·23
Brecon & Radnor	2	38·61	40·00	31·40	37·31
Cumberland & Westmorland	2	34·23	32·01	30·29	32·01
Hertfordshire	2	27·16	26·03	26·13	28·14
Lancashire	2	21·70	24·40	22·67	21·66
Lincolnshire (Lindsey)	2	21·57	25·85	22·00	26·12
Merionethshire	2	10·82	12·07	10·14	11·88
Nottinghamshire	2	25·09	19·16	18·18	18·62
Surrey	2	21·78	20·80	16·88	21·59
Cambridgeshire	1	26·14	26·21	21·70	19·56
Carnarvonshire	1	36·15	31·77	32·90	33·30
Durham	1 (b)	29·54	17·75	10·79	27·11
Flintshire	1	33·50	32·00	30·50	28·00
Isle of Wight	1	17·35	21·70	18·69	21·83
Lincolnshire (Holland)	1	49·60	40·41	45·90	41·27
Staffordshire	1	35·00	32·00	31·00	28·00
Suffolk (East)	1	23·25	20·85	21·75	22·88
Yorkshire	1	21·22	22·72	21·22	24·18

(a) In one trial the land was markedly irregular in fertility.
(b) Land irregular.

The relative positions of the varieties show a certain amount of variation as between one county and another. In 20 out of the 26 counties either

Eagle or Star headed the list of yields, and in 16 counties Progress was at the bottom of the list.

The average yields of the supplementary varieties are given in Table III, together with the average yield of Eagle at the centres at which each variety was grown.

Table III.

Variety	No. of returns	Average yield of grain (cwt. per acre)	
		Variety	Eagle
Abundance	1	25·25	25·63
Elder	2	19·38	20·84
Marvellous	4	28·82	27·40
Pure Line Potato	6	26·08	34·63
Resistance	1	22·27	17·35
Superb	1	12·43	7·29
Supreme	1	14·66	7·29
Victory	8	29·33	28·56
Yielder	2	32·73	34·23

STRAW.

Lodging was recorded at eight centres only, and was generally slight. No conclusions can therefore be drawn as to the varietal standing power.

At 29 centres the straw was weighed, the average yields being as follows :—

Eagle	... ...	26·82 cwt. per acre
Golden Rain II	...	26·79 ,, ,, ,,
Progress	... ...	26·55 ,, ,, ,,
Star	... ...	27·08 ,, ,, ,,

There was clearly very little difference in the yields of straw from the four varieties.

VALUE OF GRAIN.

Samples of grain from 33 of the centres were valued locally. In many cases the same figure was quoted for all of the varieties, and the average valuations were therefore similar, Eagle, Golden Rain II and Progress being valued at 6/4d. and Star at 6/5d. per cwt.

SUMMARY.

The results are similar to those for 1934, but the differences are generally smaller. Eagle and Star give much the same yield, followed by Golden Rain II, although in Wales this order is reversed. Progress gives a definitely lower yield than any of the other varieties.

It was again noted at a number of centres that Eagle was somewhat later in ripening than Star, and in many districts Star may be preferred on this account.

Star also produced a slightly more saleable grain.

REPORT ON THE QUALITY—

FOR BREAD-MAKING PURPOSES—OF WHEATS

HARVESTED IN 1935.

AT THE HEADQUARTERS AND THE SUB-STATIONS OF THE NATIONAL INSTITUTE OF AGRICULTURAL BOTANY.

For many years past the study of the wheats grown at various stations by the National Institute of Agricultural Botany has been carried out by the late Sir Albert Humphries and his colleagues and assistants at Coxes Lock Mills, Weybridge. The investigations were made, and the Reports issued, on behalf of the Home Grown Wheat Committee of the Incorporated National Association of British and Irish Millers.

Owing to the death of Sir Albert Humphries, the Home Grown Wheat Committee of the Incorporated National Association of British and Irish Millers requested the Research Association of British Flour Millers to undertake the investigations, and issue the Report for the current year.

The wheats examined were the following :—

Key No.	Lab. No.	Designation	Remarks
		High Farming Trial.	
1	W.151	Steel	Intensively manured; equal quantities from Cambridge and Newport.
2	W.152	W.70A	
3	W.153	162/8/1E	
4	W.154	162/55/1	
5	W.155	Yeoman II	
6	W.156	Squarehead's Master	
7	W.157	Steel	Normally manured; equal quantities from Cambridge and Newport.
8	W.158	W.70A	
9	W.159	162/8/1E	
10	W.160	162/55/1	
11	W.161	Yeoman II	
12	W.162	Squarehead's Master	

Key No.	Lab. No.	Designation	Remarks
		Normal Strip Trials.	
13	W.163	162/55/1	Sample bulked: equal quantities from Cambridge, Cannington, Long Sutton, Newport and Sprowston.
14	W.164	Squarehead's Master	Control to No. 13: bulked samples as No. 13.
15	W.165	Redman	Bulked sample: equal quantities from Cambridge, Cannington, Newport and Sprowston.
16	W.166	Yeoman II	Control No. 15: bulked sample as No. 15.
17	W.167	Brown's 15/100	Bulked sample: equal quantities from Cannington and Sprowston.
18	W.168	Squarehead's Master	Control to No. 17: bulked sample as No. 17.
		Spring Sown Wheats.	
19	W.169	W.81	Bulked sample: equal quantities from Cannington, Newport and Sprowston.
20	W.170	April Bearded	Control to No. 19: bulked sample as No. 19.

NOTES ON THE WHEATS.

The wheats had been threshed with a small experimental thresher and in consequence contained some small and broken grain.

Without exception all the samples were plump and of attractive appearance. The bushel weight of the dry cleaned wheat varied from 64·4 to 67·5 lb. There was substantially no difference in bushel weight between the intensively and the normally manured samples, but the wheats from the normal strip trials were of lower bushel weight (about 1 lb. lower) than the corresponding wheats from the high farming trials.

On the whole, type of manuring (whether intensive or normal) did not affect the protein content of the wheats but in the three cases in which comparisons were possible the wheats from the normal strip trials were 1 to 1½% lower in protein content than those from the high farming trials.

The screenings were all very similar in character and ranged in amount from 1·1 to 4·8%. They contained considerable quantities of small and broken grain. They were all characterised, too, by having up to approximately 1% of very shrivelled " gummy " grain, a condition which indicated some peculiar and rather unusual form of damage.

Table I.

ANALYTICAL DATA ON THE WHEATS.

	Moisture %	Bushel Weight (lb.)		Protein Content %
		As received.	Cleaned.	
STEEL:				
Intensive Manuring ...	14·81	63·6	64·8	9·27
Normal ,, ...	14·76	63·3	64·8	9·10
W.70A:				
Intensive Manuring ...	14·09	65·2	66·6	10·15
Normal ,, ...	14·40	64·4	66·9	11·03
162/8/1E:				
Intensive Manuring ...	14·32	64·0	65·4	9·61
Normal ,, ...	14·83	62·1	64·4	9·04
162/55/1:				
Intensive Manuring ...	14·52	65·6	66·6	9·52
Normal ,, ...	14·82	64·6	66·8	9·44
Normal Strip Trial ...	14·17	64·3	65·4	8·02
YEOMAN II:				
Intensive Manuring ...	14·10	63·7	65·8	9·59
Normal ,, ...	14·60	65·8	67·0	9·87
Normal Strip Trial ...	14·32	64·1	65·4	8·65
SQUAREHEAD'S MASTER:				
Intensive Manuring ...	14·55	64·5	66·6	10·48
Normal ,, ...	15·27	65·6	66·7	10·30
Normal Strip Trial (No. 14)	13·63	64·8	65·8	8·81
,, ,, ,, (No. 18)	14·88	64·4	65·2	9·00
REDMAN:				
Normal Strip Trial ...	14·02	63·3	64·6	9·02
BROWN'S 15/100:				
Normal Strip Trial ...	15·08	63·1	64·5	8·56
W.81:				
Spring sown	15·19	66·1	67·5	9·82
APRIL BEARDED:				
Spring sown	15·53	65·6	67·0	10·26

MILLING BEHAVIOUR.

As the samples were unusually dry all required to be moistened to bring them into a suitable condition for milling. For this purpose the necessary cold water was added to the wheat in a revolving drum cold conditioner and the wheat was allowed to stand over night before milling.

All milled well although No. 20 (April Bearded) dressed poorly. Nos. 2, and to a less extent 8, (the two samples of W.70A) were perhaps best in milling characteristics : they gave stocks which were easy to clean and which dressed unusually well giving a very granular flour.

The flour extractions obtained varied between 64·1 and 68·7% calculated on the wheat at 1st break; the average was 65·8%. A full commercial extraction is not aimed at in our system of laboratory milling and no particular significance is to be attributed to the extraction figures. They are given as an indication that good length but not full commercial extractions were obtained. The flour of greatest length (68·7%) had ash content of 0·520%.

APPEARANCE OF FLOURS

All flours were of excellent colour and bloom. Nos. 1, 7, 14, 17 and 18 were of better colour than an untreated London + 1/- grade; samples 3, 5, 6, 9, 12, 15 and 20 were much alike and similar to the London flour. Nos. 2, 4, 8, 10, 11, 13, 15, 16 and 19 were of deeper colour, a somewhat brownish cream, the colour being accentuated by the relatively very granular character of the flours : they were the most granular of the set.

NOTES ON THE FLOURS.

As would be expected from the data on the wheats, gluten content of the flour was not affected by extent of manuring in the high farming trials the average dry gluten figure being 8·85% for the intensively manured flours and 8·9% for the normally manured. Again the gluten content was materially lower in the flours from the normal strip trials than in those from the high farming trials.

Maltose figure, like gassing power, did not appear to be affected by type of manuring.

The characters of the washed out glutens require no separate comment except that of W.163 (Variety 162/55/1 — normal strip trial). On Dec. 17th, 1935, the gluten was abnormal and could not be washed out. It yielded only a slimy paste. In view of the abnormal baking results recorded later gluten was re-determined on Jan. 10th, 1936. The gluten broke up badly in the early stages of washing but recovered somewhat and did eventually yield a soft gluten ball of poor spring and only fair extensibility. The amount of dry gluten obtained was 7·0%.

Table II.

ANALYTICAL DATA ON THE FLOURS.

	Moisture	Maltose Figure	Dry Gluten
STEEL :			
Intensive manuring ...	14·67	0·8	8·4
Normal ,, ...	14·89	0·7	8·1
W.70A :			
Intensive manuring ...	15·30	1·7	9·5
Normal ,, ...	14·80	1·6	10·4
162/8/1E :			
Intensive manuring ...	15·07	1·4	8·7
Normal ,, ...	14·82	1·35	7·9
162/55/1 :			
Intensive manuring ...	14·98	1·7	8·1
Normal ,, ...	14·32	1·75	8·4
Normal strip trial ...	15·03	1·2	None : 7·0% at a later date
YEOMAN II :			
Intensive manuring ...	15·40	1·5	8·85
Normal ,, ...	14·96	1·5	9·1
Normal strip trial ...	15·17	1·5	7·8
SQUAREHEAD'S MASTER :			
Intensive manuring ...	14·35	0·9	9·6
Normal ,, ...	14·66	0·8	9·4
Normal strip trial (No. 14)	14·94	0·7	7·4
,, ,, ,, (No. 18)	14·34	0·7	7·3
REDMAN :			
Normal strip trial ...	14·82	1·05	7·6
BROWN'S 15/100 :			
Normal strip trial ...	14·76	0·9	6·5
W.81 :			
Spring sown	14·35	0·65	8·6
APRIL BEARDED :			
Spring sown	14·32	0·7	9·1

GAS PRODUCTION.

In each gas test the following amounts of material were used : 50 gms. flour, 1 gm. (= 2% of weight of flour) of yeast, 0·625 gm. (= 1¼%) of salt, and 30 ccs. of water. The temperature of fermentation was maintained at 83°F.

Gas production figures (in c.c.) are given in the Table together with those of X reference flour with which the flours were blended in some of the baking tests. X flour is a good quality standard grade London commercial flour.

The flours varied widely in gassing power, from moderately good to poor. Only two (Nos. 10 and 11) showed increasing hourly gas production for four hours, ten (Nos. 2, 3, 4, 5, 8, 9, 13, 15, 16 and 17) reached their maximum in the third hour, while the remaining eight (Nos. 1, 6, 7, 12, 14, 18, 19 and 20) reached their maximum in the second hour. In six cases (Nos. 1, 6, 7, 18, 19 and 20) the maxima attained were unsatisfactorily low, i.e., well below 100 c.c. ; these together with No. 12 would benefit, under any system of baking, through addition of some gassing help such as malt products. In some other cases, e.g., Nos. 3, 9, 13, 14, the descent from the maximum was rapid. Thus with No. 9 gas production fell suddenly from the maximum 105 c.c. in the third hour to 53 c.c. in the fourth. With these, gassing aids would probably be helpful in long baking systems. The remaining nine (Nos. 2, 4, 5, 8, 10, 11, 15, 16 and 17) may be regarded as satisfactory.

If the flours are divided into three groups, viz., satisfactory gassers, poor gassers, and those of intermediate gassing capacity which might need the help of malt products with certain baking systems it will be seen that the grouping is unaffected by type of manuring. All three groups are represented among both intensively and normally manured wheats while each given variety of flour belongs to the same gassing group in both manurial sets.

BAKING TRIALS.

Since the methods of test baking in use at these laboratories differ somewhat from those adopted by the Home Grown Wheat Committee all the flours were examined by both sets of methods. It may be said at once that the results were substantially the same in both cases : similar bread was obtained and the order of merit of the flours was the same both when the Home Grown Wheat Committee's baking methods and when the Research Association's baking methods were used.

For details of the Committee's baking methods earlier reports should be consulted. It is sufficient to state that for many years four standard tests were employed in testing every flour, viz.,

1½% yeast with a 3 hour's fermentation (including final proof)
1% ,, ,, ,, 4 ,, ,, ,, ,, ,,
0·75% ,, ,, ,, 6 ,, ,, ,, ,, ,,
0·5% ,, ,, ,, 8 ,, ,, ,, ,, ,,

The dough temperature in every case was maintained throughout at 80°F.

In this system of test baking there are two variables—amount of yeast and time of fermentation. In the Research Association's methods a dough

Table III.

GAS PRODUCTION, with 2% D.C.L. Yeast, $1\frac{1}{4}$% salt, dough at 80°F.

Lab. No.	Gas volumes, ccs. per hour. 1st	2nd	3rd	4th	5th	6th	7th	8th	Total 24 hrs.	Maltose	
W151	50	88	62	23	18	17	12	8	330	0·8	Steel. Intensively manured
W152	50	87	106	87	36	22	18	14	508	1·7	W.70A ,, ,,
W153	50	90	102	63	35	22	18	10	480	1·4	162/8/1E ,, ,,
W154	50	90	107	93	40	30	20	13	548	1·7	162/55/1 ,, ,,
W155	50	88	105	97	60	40	26	17	670	1·5	Yeoman II ,, ,,
W156	57	89	84	32	21	20	17	13	440	0·9	Sqrhd. Master ,, ,,
W157	50	90	63	20	17	17	13	12	352	0·7	Steel. Normally ,,
W158	50	90	117	70	33	23	17	18	515	1·6	W.70A ,, ,,
W159	50	95	105	53	32	27	18	13	538	1·35	162/8/1E ,, ,,
W160	54	93	113	114	44	29	20	15	640	1·75	162/55/1 ,, ,,
W161	46	89	107	112	76	42	31	24	770	1·5	Yeoman II ,, ,,
W162	50	100	84	36	26	17	11	6	452	0·8	Sqrhd. Master ,, ,,
W163	60	95	100	67	31	22	19	16	565	1·2	162/55/1 Normal Strip Trials
W164	50	103	69	31	24	19	14	10	440	0·7	Sqrhd. Master ,, ,, ,,
W165	54	96	102	71	39	31	27	20	610	1·05	Redman ,, ,, ,,
W166	55	93	99	93	75	49	36	22	768	1·5	Yeoman II ,, ,, ,,
W167	50	90	100	64	38	28	20	15	570	0·9	Brown's 15/100 ,, ,, ,,
W168	55	90	83	39	25	20	15	8	490	0·7	Sqrhd. Master ,, ,, ,,
W169	46	89	67	28	18	12	8	4	350	0·65	W.81 (Spr.sown) ,, ,, ,,
W170	50	93	67	30	17	17	14	8	385	0·7	April Bearded

temperature of 80°F. and a constant amount of yeast (2%) are employed, the only variable being fermentation period. With English flours, which stand only relatively short fermentations, the periods used are 2½, 3¼, 4 and 4¾ hours. Practically all English flours would throw their best loaves within this range of fermentation time; in exceptional cases the time could be extended to 5½ hours. Owing to the larger amount of yeast used, this system involves a somewhat greater strain on the gassing capacity of the flour, but as a rule not greater than can be met by the use of 0·1% highly diastatic malt extract and 0·05% ammonium phosphate; those additions were employed also by the Home Grown Wheat Committee.

This method of test baking has been called the *multiple differential* system — *multiple* because several simultaneous bakes are involved of progressively increasing severity, *differential* because an attempt is made to assess the flour's response to equal increments of severity of fermentation.

In addition to these tests all the flours were blended to the extent of 30% with a good quality commercial London flour made from a mixture of wheats, which for the purpose of reference we call X flour.

The trials were carried out on five different days as follows :

Samples	1	to	6 —	high farming, intensive manuring.
,,	7	,,	12 —	,, ,, , normal ,,
,,	13	,,	18 —	normal strip trials
,,	19	,,	20 —	spring sown wheats
,,	1	,,	20 —	blended with X flour.

So far as could be judged both from doughs and loaves samples Nos. 7 to 12 were substantially replicates of the corresponding samples Nos. 1 to 6 : the differences in manuring were not reflected in differences in baking quality. On the other hand, the normal strip trials yielded less satisfactory results. The bread was not quite up to the same quality while the doughs were all poor, the best being markedly inferior to the corresponding one from the high farming trials.

Liquor at the rate of 15 galls. per sack was given to all. All doughs were of good body but rather claylike at making, but fell off to different degrees towards scaling. Of the twelve high farming trials the poorest doughs (tender, with flat pinholey tops) at scaling were the two Squarehead's and the two Steels. The two W70A were outstanding in the dough as they were in the bread. The remainder were intermediate with no marked difference between them; 162/55/1 (No. 4) seemed the best of this intermediate set : it had fallen off less than the others at scaling.

The normal strip trials yielded poor doughs : the poorest were the two Squarehead's, Brown's 15/100 and 162/55/1 (No. 13; this one gave no gluten on washing out); the best of a poor set was Yeoman II (No. 16), with Redman only slightly inferior.

The story told by the bread was in general similar to that of the doughs.

In the high farming trials W70A was outstandingly the best, the bread being in all characters really first rate for all-English. Yeoman II came next : its bread was quite good but definitely inferior to W70A in all crumb characters and volume. Steel, 162/8/1E, and 165/55/1 — in that order — formed an intermediate group of fair quality; the differences between them were not

marked. The Squarehead's Master was not only outstandingly the worst but was outstandingly bad. In fact all four Squarehead's Master (Nos. 6, 12, 14 and 18) were very similar and quite unfit for breadmaking alone. The bread was of small volume, with poorly developed face, harsh texture and open honeycomb grain — altogether most unappetising.

Of the flours from the normal strip trials, the two Squarehead's Master (Nos. 14 and 18) were, as has already been mentioned, of poor quality and unsuitable for breadmaking. Brown's 15/100 was closely similar to the Squarehead's. Yeoman II (No. 16) was a little inferior to the two Yeoman's of the high farming trials (Nos. 5 and 11) while Redman was slightly better in general all-round quality to No. 16, being very similar to Yeomans Nos. 5 and 11.

162/55/1 (No. 13) was peculiar in some respects. It would be expected to be similar to the other 162/55/1 (Nos. 4 and 10). Actually no gluten at all was obtainable on washing out and from this it would have been reasonable to infer that in the bakehouse this sample would be the poorest of the set and its bread of the worst possible quality. In all the tests it was superior to all the Squarehead's; moreover, the bread improved progressively in crumb quality and volume with increasing severity of fermentation. On the Humphries system the best loaf was thrown at eight hours (all the other flours produced their best bread between 4 and 6 hours). Moreover this loaf was a reasonably satisfactory all-English loaf, better than 162/55/1 (Nos. 4 and 10) and similar in quality to the Yeomans and Redman.

On the whole, however, this sample should be rated low because it required special treatment, i.e., an unduly long fermentation, and its response to those baking processes generally suitable for English flours was unsatisfactory. In any case this sample was anomalous in behaviour.

The two spring sown wheats W81 and April Bearded behaved in the bakehouse in a manner that can only be described as extraordinary. They were both closely alike and we can confirm the statement made concerning the latter of these two wheats in the last Home Grown Committee's Report August, 1934, p. 10) : " April Bearded in many seasons has presented some difficult technical problems. Almost always it has seemed to possess potentialities of good results, difficult or impossible to achieve."

The doughs behaved well in the earlier stages of fermentation but appeared to collapse quite suddenly before final proof, the resulting bread being small, of harsh crumb and altogether unappetising and almost uneatable.

The result appeared to be due either to insufficiency of gas or to inability of the gluten to retain the gas produced. Although the flour alone was a poor gasser, gas production throughout fermentation should have been adequate in view of the 2% sugar added with the liquor.

However, gas tests were carried out on April Bearded flour with the following additions: 2% sugar, 0·2% highly diastatic malt extract + 0·1% ammonium phosphate, 0·2% " pure " diastase, 2% gelatinised starch, 0·2% diastase + 2% gelatinised starch.

There are two essential factors in gas production: (1) an adequate amount of the enzyme *diastase* and (2) starch which can be *easily* attacked by the diastase. A deficiency of gas production may be due to a lack of one or

both of these factors. The figures given in Table IV (Columns 4, 5, and 6) show that April Bearded is not well supplied with either of the factors and that deficiency of diastase is the more important of the two. However, the addition of 2% sugar ensured adequate gas production.

Baking tests were repeated at three fermentation times (3¼, 4 and 4¾ hours) using all the additions as gassing aids used in Table IV — five sets in all — but little or no improvement in baking quality resulted.

The cause of the trouble was evidently excessive gas leakage due to collapse of the gluten. This was confirmed by carrying out further baking tests using methods involving particularly short fermentation times. The object was to send the doughs to the oven fully ripe after so short a time in the dough stage that there was insufficient time for the gluten to deteriorate to the degree of allowing excessive gas leakage. This was done in two ways: (1) by using a short sponge method of breadmaking. Two lb. of flour were made into a sponge with 20 ozs. water, 2 oz. yeast and 1 oz. sugar, and was allowed to rise and drop; this took half-an-hour. To 1½ lb. of flour, 10 ozs. of water and 1 oz. salt were added. The sponge was broken up and added to this mixture and a dough made. This was allowed to lie 10 minutes and was then scaled and moulded, and allowed to prove for 35 minutes before being placed in the oven. (2) By using a no-time dough method. A relatively large amount of yeast, e.g., 4%, was used, the two dough stages were of only ten minutes each, followed by the usual proofing period of 35 minutes.

Table IV.

GAS TESTS ON APRIL BEARDED.

Time	I Alone	II + 2% sugar	III + 0·2% M.E. + 0·1% A.P. *	IV + 0·2% Diastase	V + 2% gel. starch	VI + 0·2% diastase + 2% gel. starch.
1st hour ...	45	54	58	50	40	43
2nd ,, ...	67	108	100	80	82	86
3rd ,, ...	58	104	65	109	95	93
4th ,, ...	19	89	60	86	55	84
5th ,, ...	18	75	38	74	33	82
6th ,, ...	11	40	33	34	16	76
Total for 24 hours ...	368	617	590	985	456	1040

* M.E. = malt extract. A.P. = ammonium phosphate.

In both cases satisfactory bread was obtained. The loaves were comparable with those from the Yeoman II samples made by the straight dough processes.

Evidently the potentialities of the two spring wheats can only be brought out by using special baking methods which are not commonly used

commercially in this country. With baking processes normally used with English flours these two spring wheats are definitely and markedly unsatisfactory. As far as April Bearded is concerned the reports of the Home Grown wheat Committee seem to support the suggestion that the defects are varietal and not seasonal for this wheat has given similar unsatisfactory results for a number of years.

SUMMARY.

Eight varieties of wheat grown under a variety of conditions (20 samples in all) were examined.

The samples grown on intensively manured plots showed similar gluten content, maltose figure, gassing power and baking quality to those grown on normally manured plots. On the other hand, the high farming trials produced wheats of definitely better baking quality than those grown on the normal strip trials.

Of the separate varieties, W70A was outstandingly the best and was of excellent baking quality. Yeoman II came next but was definitely inferior to W70A in all crumb characters and volume. Steel, 162/8/1E, 162/55/1 and Redman formed an intermediate group of fair quality. Squarehead's Master and Brown's 15/100 were poor and unfit for breadmaking.

The two spring wheats W81 and April Bearded were anomalous in their behaviour and must be regarded as unsuitable for breadmaking under commercial baking systems usual in this country.

E. A. FISHER,
Director of Research.

March 6th, 1936.

REPORT OF THE POTATO SYNONYM COMMITTEE

ON THE POTATOES SENT FOR IMMUNITY TRIALS TO THE POTATO TESTING STATION, ORMSKIRK, LANCASHIRE, 1935.

The following served on the Committee :—

F. J. Chittenden, F.L.S. R. B. Strang, N.D.A.,
W. D. Davidson, B.A., B.Sc., B. C. C. Waight,
A. W. McAlister,
and
Redcliffe N. Salaman, M.D., J.P., F.R.S. (Chairman).

The 1935 season was again one of more or less severe drought, and following the severe frosts of mid May it proved a difficult one for the potato crop. These adverse conditions did not, however, seriously check the growth of the plants at Ormskirk, which had enjoyed a good start earlier in the season and were at the time of the Committee's visit in the best stage of growth for inspection. This was the more remarkable in view of the fact that the soil of the immunity trial field was this year found to be heavily infected with eelworm. In two plots only did the growing plants appear to have suffered by reason of the infection.

The severe frosts, the dry and very hot season, and the severe winds towards the end of July all combined to hinder early tuberation and the development of wart disease.

The long standing custom of planting a duplicate set of small plots on a piece of intensely wart infested soil near the farm house enabled the staff to check the results of the larger plots and to confirm all the results which had been obtained by the glasshouse test during the winter.

Last year the Committee were able to record the absence of any synonyms amongst the new stocks sent in for trial; this year a relapse has to be recorded. There were three cases of synonyms of well-known varieties, one of an obscure variety called Cleveland and one of the lately introduced foreign variety Bintje, a potato used exclusively for the manufacture of potato crisps. The latter is particularly to be deplored because its appearance recalls the worst features of earlier days, when a variety, whether recently introduced or not, had only to become popular to receive immediately a new name. This year, of 76 supposed new varieties 6·6 per cent. are synonyms. Freedom from these dubious practices can only be bought, like Liberty, at the cost of eternal vigilance, and it is clear that the Synonym Committee has still work to do.

The old battle of the catalogues still goes on. This year twelve seedsmen included in their lists twenty-seven so-called distinct varieties, each of which was identical with one or other well-known variety. Last year the same number of seedsmen advertised twenty-three such false varieties. The true and synonymous stocks were planted as usual in that part of the experimental farm which is specially set aside for the purpose of exhibiting the identity of these falsely named stocks and their comparison with the genuine ones. These exhibits, which have aroused much interest in those concerned in the potato trade, have played a valuable part in the welcome reaction which we have to chronicle in this report.

This year we append a list of the prices asked by the firms in question for the synonymous varieties and their genuine counterparts, an examination of which proves that the Committee has not been tilting at windmills in its untiring fight to suppress the synonymous habit.

As a result of negotiations with those firms which have continued to advertise synonymous stocks in their catalogues, we are glad to report that the majority of those synonyms recorded on p. 162 are either to be withdrawn in the forthcoming trade catalogues or are to be appropriately and correctly described as synonymous with existing named varieties.

The 1935 entries fall into the following groups :—

List	I	5 stocks are synonyms of recognized distinct varieties.
,,	II	1 stock too mixed to be judged.
,,	III	4 stocks too poor to be judged.
,,	IV	2 stocks not true to key plots.
,,	V	1 stock duplicate of existing entry.
,,	VI	Interdepartmental Check varieties : consisting of 15 distinct varieties free from wart disease 2 other entries included in Lists IV and V respectively.
,,	VII	6 distinct varieties susceptible to wart disease.
,,	VIII	47 distinct varieties free from wart disease.

The Committee have great pleasure in recording their complete satisfaction with the management of the trials and their indebtedness to Mr. Bryan and Mrs. McDermott for their untiring help and expert advice. They also desire to record their appreciation of the excellent work of Mr. Sharrock, the foreman.

(Signed on behalf of the Committee),

REDCLIFFE N. SALAMAN.

I. SYNONYMOUS STOCKS.

Plot No.	Variety.	Name of Sender.	Incidence of Wart Disease.
		BINTJE.	
110	No. 108 Primrose	Harrison & Sons (Maidstone) Ltd., Maidstone, Kent.	Wart present.
		EPICURE.	
115	Plantation 2nd Early	R. Paton, Port Glasgow.	Wart present.
		KING EDWARD VII.	
118	Jubilee Rose	J W. Radford, Ashbourne, Derbyshire.	Wart present.
		TINWALD PERFECTION.	
114	Rob, The Rover	W. B. Charlton, Lesbury, Northumberland.	No wart seen.

II. STOCKS TOO MIXED TO BE JUDGED.

96	5160	Sutton & Sons, Ltd., Reading.	No wart seen.

III. STOCKS TOO POOR TO BE JUDGED.

69	Derrick	J. Sumner, Bickerstaffe, Ormskirk.	No wart seen.
112	Cargo	ditto	,, ,, ,,
116	No. 1	R. A. Watts, Bridgwater, Somerset.	Wart present.
117	Newbarns Wonder	G. H. Mackereth, Ltd., Ulverston.	,, ,,

IV. STOCKS NOT TRUE TO KEY PLOTS.

64	D. 3/31	Dobbie & Co., Ltd., Edinburgh.	No wart seen.
67	D. 6/31	ditto	,, ,, ,,

V. INTER-DEPARTMENTAL CHECKS.

		DISTINCT VARIETIES :	
119	8306 McGill & Smith	Department of Agriculture for Scotland.	No wart seen.
120	B.68 Spence	ditto	,, ,, ,,
121	E.109 Spence	ditto	,, ,, ,,
123	212a (22) S.S.R.P.B.	ditto	,, ,, ,,
124	212a (82) S.S.R.P.B.	ditto	,, ,, ,,
125	212a (111) S.S.R.P.B.	ditto	,, ,, ,,
126	264 (37) S.S.R.P.B.	ditto	,, ,, ,,
127	K. 36 Harper	ditto	,, ,, ,,
129	Kitty Glen — Cochrane	ditto	,, ,, ,,
131	608 Pollock	ditto	,, ,, ,,
133	14/31 M. of A.	Department of Agriculture for Northern Ireland.	,, ,, ,,
134	1/31 Smyth	ditto	,, ,, ,,
135	230/31 Smyth	ditto	,, ,, ,,
136	216/31 Smyth	ditto	,, ,, ,,
137	378 J. Clarke	ditto	,, ,, ,,
STOCK SYNONYMOUS WITH CLEVELAND :			
132	Stuart A.	Department of Agriculture for Scotland.	,, ,, ,,
DUPLICATE OF PLOT 64 :			
128	B. 28/30 Dobbie	ditto	,, ,, ,,

VI. DISTINCT VARIETIES SUSCEPTIBLE TO WART DISEASE.

Plot No.	Variety.	Name of Sender.	Incidence of Wart Disease.
76	222/15	D. MacKelvie, Lamlash.	Wart present.
87	1321	McGill & Smith, Ltd., Ayr.	„ „
90	1328	ditto	„ „
93	5326	ditto	„ „
99	5177	Sutton & Sons, Ltd., Reading.	„ „
107	C.S. 1/33	Dobbie & Co., Ltd., Edinburgh.	„ „

VII. DISTINCT VARIETIES FREE FROM WART DISEASE IN THE FIELD.

SECOND YEAR STOCKS :		
2	1309	McGill & Smith, Ltd., Ayr.
5	103021	ditto
7	10319	ditto
10	9311	ditto
13	10313	ditto
16	5313	ditto
18	9298	ditto
21	180/27	D. MacKelvie, Lamlash.
23	183/15	ditto
26	193/10	ditto
28	193/23	ditto
31	193/40	ditto
33	193/89	ditto
35	193/101	ditto
37	203/10	ditto
40	A. 13	C. T. Spence, Dunbar.
42	A. 17	ditto
44	E. 13	ditto
47	5111	Sutton & Sons, Ltd., Reading.
50	5140	ditto
52	5166	ditto
54	134 (5)	Scottish Society for Research in Plant Breeding, Edinburgh.
57	151 (39)	ditto
60	212a (30)	ditto
62	967c (38)	ditto
FIRST YEAR STOCKS :		
71	183/6	D. MacKelvie, Lamlash.
73	193/53	ditto
74	222/5	ditto
77	222/16	ditto
78	222/20	ditto
79	222/21	ditto
80	226/10	ditto
82	2316	McGill & Smith, Ltd., Ayr.
84	53112	ditto
86	103125	ditto
89	1327	ditto
92	3323	ditto
94	5328	ditto
97	5165	ditto
98	5174	ditto
101	5181	ditto
102	5190	ditto
104	E. 8	C. T. Spence, Dunbar.
105	E. 43	ditto
106	G.178	ditto
108	127/33	Dobbie & Co., Ltd., Edinburgh.
109	134 (139)	Scottish Society for Research in Plant Breeding, Edinburgh.

REPORT ON PURCHASED STOCKS OF SYNONYMS, 1935.

Name under which stock was purchased.	Vendor.	Result of examination in 1935. Synonymous with	When previously tested found to be synonymous with	Price per stone.	
				Synonymous stock.	Standard variety
*Queen of the Earlies	Baker, Codsall, nr. Wolverhampton	Duke of York	Duke of York	2/6	1/10
*Queen of the Earlies	C. M. Haigh, Chatteris, Cambs.	Duke of York	This synonym has not been purchased from this firm previously.	1/3	1/3
*Chester Early	McHattie & Co., Chester	Duke of York	Duke of York	3/-	2/6
Cherub	D. & W. Croll Ltd., Dundee	Duke of York	Duke of York	2/4	1/9
Victory	Tillie, Whyte & Benvie, Edinburgh	Duke of York	Duke of York	2/-	2/-
*Victory	C. M. Haigh, Chatteris, Cambs.	Duke of York	This synonym has not been purchased from this firm previously.	1/3	1/3
Express	E. Webb & Sons (Stourbridge) Ltd., Stourbridge	Sharpe's Express	Sharpe's Express	2/3 per 7 lb.	2/- per 7 lb.
Early Favourite	S. Finney & Co. Ltd., Newcastle-upon-Tyne	Sharpe's Express	Sharpe's Express	1/6	1/6
*Early Favourite	C. M. Haigh, Chatteris, Cambs.	Eclipse	This synonym has not been purchased from this firm previously.	1/3	1/3
*Earliest of All	J. E. Knight & Son, Wolverhampton	Sharpe's Express	Sharpe's Express	2/9	2/-
*First Crop	Carters Tested Seeds Ltd., London	Sharpe's Victor	Sharpe's Victor	5/-	5/-
Colonist	E. Webb & Sons (Stourbridge) Ltd., Stourbridge	Eclipse	Eclipse	2/9 per 7 lb.	2/3 per 7 lb.
*Advancer	Carters Tested Seeds Ltd., London	Eclipse	Eclipse	4/6	4/3
*Advancer	C. M. Haigh, Chatteris, Cambs.	Eclipse	This synonym has not been purchased from this firm previously.	1/3	1/3
*Dreadnought	J. E. Knight & Son, Wolverhampton	Great Scot	Great Scot	3/-	1/9
*Royalty	Carters Tested Seeds Ltd., London	British Queen	British Queen	4/6	4/-
Cleadon Park	S. Finney & Co. Ltd., Newcastle-upon-Tyne	Red King Edward VII	Red King Edward VII	1/8	1/8
*Mons Star	C. M. Haigh, Chatteris, Cambs.	King Edward VII	King Edward VII	1/-	1/-
Mons Star	R. Morris, Coupar Angus	King Edward VII	This synonym has not been purchased from this firm previously.	85/- ton	75/- ton
New Renown	E. Webb & Sons (Stourbridge) Ltd., Stourbridge	Abundance	Abundance	2/3 per 7 lb.	2/- per 7 lb.
*Scottish Triumph	McHattie & Co., Chester	Up-to-Date	Up-to-Date	2/3	2/3
Prosperity	E. Webb & Sons (Stourbridge) Ltd., Stourbridge	Up-to-Date	Up-to-Date	2/3 per 7 lb.	2/- per 7 lb.
*Tremendous	Toogood & Sons Ltd., Southampton	Up-to-Date	Up-to-Date	4/6	3/6
Sensation	Daniel Bros., Norwich	Up-to-Date	Up-to-Date	2/6	—
*Longkeeper	Carters Tested Seeds Ltd., London	Up-to-Date	Up-to-Date	4/6	3/9
*Factor	ditto	Up-to-Date	Up-to-Date	3/9	3/9
*Factor	C. M. Haigh, Chatteris, Cambs.	Up-to-Date	This synonym has not been purchased from this firm previously.	1/-	1/3

* It is understood that these synonyms will not appear in the future catalogues of the firms concerned.

REPORT OF THE POTATO SYNONYM COMMITTEE

ON THE POTATOES SENT FOR IMMUNITY TRIALS TO THE POTATO TESTING STATION, ORMSKIRK, LANCASHIRE, 1936.

The following served on the Committee :—

F. J. Chittenden, F.L.S., R. B. Strang, N.D.A.,
W. D. Davidson, B.A., B.Sc., B. C. C. Waight,
A. A. McAlister,

and

Redcliffe N. Salaman, M.D., J.P., F.R.S. (Chairman).

The conditions at Ormskirk in 1936 were a welcome change to those under which the trials were conducted in 1934 and 1935. Instead of drought we had frequent rains which were neither too violent nor too frequent, and hence the most favourable conditions for growth. This year the trials were carried out on the old trial ground which since 1928 had not been used for potatoes. This long rest had been carried out with the idea of combating the eelworm pest which on this piece of land had reached formidable proportions. Potatoes grown this year on the ground showed no trace of sickness and on digging only an occasional cyst was found. It will further be remembered that this field was the most highly wart infected land on the farm, and it is of interest to note the effect of an eight year rest from potatoes on subsequent wart infection. In general the control plots of susceptibles succumbed, but infection was not severe. There were, however, two varieties which gave positive reactions in the laboratory yet showed no trace of infection in the field. It is due to this uncertainty of reaction that we are placing the new variety grown in Plot 72, which gave a positive reaction of low intensity in the laboratory and a negative one in the field, in a special class. It will be tested again next year. As the weather conditions were ideal for the development of the disease one must presume that the supply of winter sporangia in the soil was reduced.

Employing our usual method for calculating the percentage of synonyms sent in for trial, viz. their relation to the total of first and second year entries less those too poor to be judged, we find two such out of fifty-one entries, i.e. 4 per cent., a reduction of 2 per cent. on that of 1935. We have not regarded Plot 2 as a synonym as it appears more probable that this was a case of two seedlings which were indistinguishable from each other.

Attention was called in the 1935 report to the fact that as a result of negotiations both personal and by correspondence several of the more prominent seedsmen who had till then retained certain synonym varieties in their catalogues had agreed to eliminate them as far as possible in the 1936 catalogues and to complete the process before 1937.

Although we can still find in several catalogues synonymous varieties offered for sale in most cases with the usual accompaniment of higher prices, we do not propose to make further comment this year on those grown and exhibited in the 1936 trial ground, a list of which will be found in this report. It is to be hoped that the remaining firms will not be long in following the example of their colleagues and thus bringing to a close a chapter in the history of the potato trade which though not redounding to its credit has not been without interest.

The following groups of entries have been examined : —

I	Synonymous stocks	2
II	Variety duplicate of another entry	1
III	Stock too poor to be judged	1
IV	Interdepartmental stocks :	
	(a) Free from wart disease	6
	(b) Susceptible to wart disease	1
V	Distinct varieties susceptible to wart disease ...	5
VI	Distinct variety of doubtful immunity	1
VII	Distinct varieties free from wart disease ...	42
	Total number of plots under examination ...	59

The Committee have much pleasure in recording their satisfaction with the layout and maintenance of the trials. To Mr. Bryan and Mrs. McDermott they would once more express their debt of gratitude for the unstinted help afforded them. They would also like to record their warm appreciation to Mr. Sharrock and his staff for the efficient husbandry of the trial ground.

(Signed on behalf of the Committee),

REDCLIFFE N. SALAMAN.

I. SYNONYMOUS STOCKS.

Plot No.	Variety	Name of sender.	Incidence of wart disease
		BISHOP.	
86	C.T.S. 3	Carter's Tested Seeds Ltd., London.	No wart seen.
		FIELD MARSHALL.	
87a	Chasemoor Wonder	O. F. G. Day, Hindhead, Surrey.	Wart present.

II. DUPLICATE OF PLOT 108.

2	183/6	D. MacKelvie, Lamlash.	No wart seen.

III. STOCK TOO POOR TO BE JUDGED.

85	No. 1	Ed. Clayton, Newburgh, near Wigan.	No wart seen.

IV. INTER-DEPARTMENTAL CHECKS.

DISTINCT VARIETIES FREE FROM WART DISEASE IN THE FIELD.

88	E.126 Spence	Department of Agriculture for Scotland.	No wart seen.
89	E.141 Spence	ditto	,, ,, ,,
90	S.1 Harper	ditto	,, ,, ,,
91	S.12 Harper	ditto	,, ,, ,,
92	316a (4) S.S.R.P.B.	ditto	,, ,, ,,
93	413 J. Clarke	Department of Agriculture for Northern Ireland	,, ,, ,,

DISTINCT VARIETY SUSCEPTIBLE TO WART DISEASE IN THE FIELD.

94	464 J. Clarke	Department of Agriculture for Northern Ireland	Wart present.

V. DISTINCT VARIETIES SUSCEPTIBLE TO WART DISEASE.

40	Newbarns Wonder	G. H. Mackereth Ltd., Ulverston	No wart seen. Field and Lab. tests positive in 1935.
64	82/34	Wm. B. Pollock, Bishopton, Renfrewshire	Wart present.
70	43131	McGill & Smith Ltd., Ayr	,, ,,
81	D.B. 1	Dobbie & Co. Ltd., Edinburgh	,, ,,
84	D.B. 4	ditto	No wart seen in field. Lab. test positive.

VI. DISTINCT VARIETY OF DOUBTFUL IMMUNITY.

72	2324	McGill & Smith Ltd., Ayr	Apparent wart reaction in lab. No wart seen in field.

VII. DISTINCT VARIETIES FREE FROM WART DISEASE IN THE FIELD.

Plot No.	Variety	Name of sender.
SECOND YEAR STOCKS.		
5	222/20	D. MacKelvie, Lamlash
7	226/10	ditto
9	2316	McGill & Smith Ltd., Ayr
12	53112	ditto
15	1327	ditto
17	3323	ditto
19	5328	ditto
22	E. 8	C. T. Spence, Dunbar
24	G. 178	ditto
26	5165	Sutton & Sons Ltd., Reading
28	5174	ditto
31	5181	ditto
34	5190	ditto
36	127/33	Dobbie & Co. Ltd., Edinburgh
38	134 (139)	Scottish Society for Research in Plant Breeding, Edinburgh
FIRST YEAR STOCKS.		
44	222/8	D. MacKelvie, Lamlash
45	232/9	ditto
46	233/10	ditto
48	233/11	ditto
49	233/13	ditto
50	233/44	ditto
52	234/6	ditto
53	234/11	ditto
55	5147	Sutton & Sons, Ltd., Reading
57	5149	ditto
58	5173	ditto
60	5178	ditto
61	5191	ditto
62	A. 40	Wm. B. Pollock, Bishopton, Renfrewshire
65	90/34	ditto
67	33120	McGill & Smith, Ltd., Ayr
68	43121	ditto
69	13134	ditto
73	3328	ditto
75	33129	ditto
76	1325	ditto
77	13125	ditto
78	188a (70)	Scottish Society for Research in Plant Breeding, Edinburgh
79	317a (3)	ditto
80	E. 109	C. T. Spence, Dunbar
82	D.B. 2	Dobbie & Co., Ltd., Edinburgh
83	D.B. 3	ditto

REPORT ON PURCHASED STOCKS OF SYNONYMS, 1936.

Name under which stock was purchased.	Vendor.	Result of Examination in 1936. Synonymous with	When previously tested found to be synonymous with
Cherub	D. & W. Croll, Ltd., Dundee	Duke of York	Duke of York
Early Favourite	S. Finney & Co. Ltd., Newcastle-upon-Tyne	Sharpe's Express	Sharpe's Express
Cleadon Park	ditto	Red King Edward VII	Red King Edward VII
Express	Carters Tested Seeds Ltd., London	Sharpe's Express	This synonym has not been purchased from this firm previously.
Advancer	ditto	Eclipse	Eclipse
Longkeeper	ditto	Up-to-Date	Up-to-Date
Colonist	Ed. Webb & Sons (Stourbridge) Ltd., Stourbridge	Eclipse	Eclipse
Express	ditto	Sharpe's Express	Sharpe's Express
Renown	ditto	Abundance	Abundance
Express	Daniel Bros., Norwich	Sharpe's Express	This synonym has not been purchased from this firm previously.
Sensation	ditto	Up-to-Date	Up-to-Date
*Mons Star	Robert Morris & Son Ltd., Coupar Angus	King Edward VII	King Edward VII

* This variety was compared in 1936 in a yield trial in the Norfolk fens with the same firm's stock of King Edward. The two were found to be identical both in appearance and in yield.

LORD DERBY GOLD MEDAL TRIALS, 1936.

H. BRYAN, B.Sc.

There were six entries for the Gold Medal trials in 1936, namely Doon Early, sent by Messrs. McGill and Smith, Ltd., of Ayr; Ulster Monarch, sent by Mr. J. Clarke, of Ballycastle, Northern Ireland; Arran Peak, sent by Mr. D. MacKelvie of Lamlash, Arran; Duke of Kent, sent by Messrs. Sutton & Sons, Ltd., of Reading; Dunbar Standard, sent by Mr. C. T. Spence of Dunbar; and Redskin, sent by Mr. Wm. B. Pollock of Bishopton, Renfrewshire.

Arran Peak and Duke of Kent were tested in the 1935 Gold Medal trials. Owing to the drought in that year Arran Peak gave inconclusive but promising results and was allowed to enter the 1936 trials. Duke of Kent also showed promise in 1935 but the cooking tests were very unfavourable; to obtain further information as to its quality the variety was allowed to enter the 1936 trials.

The trials were carried out at the Potato Testing Station, Ormskirk, on soil typical of the potato growing land of the district. Each variety was tested as far as possible against established varieties of its own season of maturity and tuber shape.

The trials consisted of either six or eight randomized single drill plots of each variety and its controls. The drills, which were drawn 28 inches apart consisted of 50 cut setts with 16 inch spacing. The best manurial practice of the district was followed. A large single plot of each variety was planted to enable the practical growers to form an opinion of each entry whilst growing.

The Committee inspected the trials a number of times during the growing season and in addition many visits were made by individual members of the Committee, on which the Institute is represented.

This year in the case of the seed of the varieties under test and their controls, there was a complete absence of any form of rot, scab, spraing or blight, except in the case of Ulster Monarch where a considerable amount of skin-spot was present. As it is known that the size of the seed affects the size of the crop and also the size of the ware potatoes, every attempt was made to arrange that the size of the seed of each variety and its controls was approximately the same, but owing to the small stock of seed of the new varieties this procedure was not always successful. As certain varieties sprout more rapidly than others under equal conditions, the lengths of the sprouts of the stocks usually varied when planted.

The produce of all stocks in the trials except the first earlies was riddled over a $1\frac{5}{8}''$ riddle.

As in other years, cooking tests of the maincrop entries were carried out at the Research Laboratories of Messrs. J. Lyons & Co., Ltd., and the Committee wish once more to record their appreciation of this important factor in the trials.

FIRST EARLY TRIAL.

DOON EARLY.

The control varieties used were Epicure and Arran Crest, stock seed from Scotland being obtained.

The seed of all stocks was received and boxed in November, 1935 and as is the practice of the district the first formed sprouts were rubbed off and the tubers re-boxed.

The trial was planted on the 6th April when the sprouts of Doon Early were 1½″ to 2″ long, ¼″ to ½″ longer than those of the control varieties.

Growth was vigorous and uniform and was not checked by the slight frost which occurred in the district during May. The foliage of Doon Early was strong and compact with broad leaflets. All plants were ostensibly virus-free. Rogues were present to the extent of 3·5% in the Doon Early stock. The rogue was identified as a distinct seedling raised by the same firm who agreed that the mixing inadvertently occurred before despatch to Ormskirk. It is known that the stocks of Doon Early grown in Scotland this year were true to type and were granted true stock certificates by the Department of Agriculture for Scotland.

Periodical lifting of plants from the surplus plots of the three stocks were made as the time approached for Lancashire earlies to appear on the market. When the Committee decided that the variety Epicure would give the highest financial return, the main trial was lifted and the produce graded by eye into marketable and non-marketable produce.

Yield of Marketable Produce.

The trial was lifted on the 7th July and the weights of marketable produce recorded and subsequently analysed statistically.

YIELD.

	Marketable produce per acre (tons)	Percentage ware.
Epicure	12·4	88
Arran Crest ...	13·9	95
Doon Early	13·8	96

Significant difference - Doon Early outyielded Epicure.

General.

In the opinion of the Committee the sample of Doon Early was more attractive than that of Epicure or Arran Crest, the tubers being larger and more uniform, a highly important point at the beginning of the first-early season when prices are high; moreover the tubers were oval in shape and the eyes less deep than those of the control varieties.

At the time of lifting the cooking quality of Doon Early was preferred to that of Epicure and Arran Crest.

Taking into consideration the heavy yield of marketable tubers of good size and shape, and the fact that all evidence obtained from this trial and elsewhere points to Doon Early being at least a week earlier in bulking than Epicure the Committee decided to award it a gold medal.

In view of its strong compact haulm the variety must be lifted in its earliest stages if intercropping with cabbages is to be practiced, but as the value of the variety lies in its extreme earliness—and consequent early lifting—the type of haulm was not felt to be any disadvantage in south-west Lancashire.

DESCRIPTION OF DOON EARLY.

Sprout : Pink.
Tuber : Oval; skin white; flesh white; eyes medium to deep.
Haulm and Foliage : Tall, upright, with close compact appearance; leaf open, rigid with arched appearance; leaflets large and broad, medium green; secondary leaflets very inconspicuous; wings straight; stems strong, green, nodes swollen.
Flowers : White, numerous; stalks short; berries occur occasionally.
Maturity : First-early.

SECOND EARLY TRIAL.

ULSTER MONARCH (J. CLARKE).

The control varieties used in this trial were British Queen and Eclipse. The seed of all three varieties was received and boxed during the week-ended 14th March, that of the control varieties was described as very good, whilst the Ulster Monarch tubers were rather severely affected with skin-spot. The trial was planted on the 7th April when the sprouts of the varieties were ¼″ to ½″ long. It was obvious that Ulster Monarch was a slow sprouter.

The trial grew normally. The number of misses was negligible, three being counted in the Ulster Monarch plots and two each in the control varieties. The British Queen and Ulster Monarch stocks were ostensibly virus-free, but traces of mosaic were detected in the Eclipse plots. The haulm of Ulster Monarch is of medium height, strong and bushy, the leaflets being large.

An attack of blight hastened the destruction of the foliage but it was apparent from the sprayed surplus plots that there was no difference in the times of ripening of the three varieties, all of which were mature by the fourth week in August.

Plants from the surplus plots were lifted and weighed during the growing season when it became evident that Ulster Monarch bulked much earlier than its controls.

The weights obtained from three plants of each variety on different dates is given below :—

	Date lifted	Saleable		Unsaleable	
		lb.	oz.	lb.	oz.
Ulster Monarch	30th July	6	10	—	
Eclipse	,,	4	8	2	0
British Queen	,,	3	10	1	12
Ulster Monarch	4th August	9	7	0	2
Eclipse	,,	5	8	1	8
British Queen	,,	7	4	1	4

The Committee were in some doubt as to the proper date on which to lift the trial but ultimately decided to allow the foliage to mature and the plots were accordingly lifted during the first week of September.

YIELD.

SUMMARY OF RESULTS (ware dressed 1⅝").

	Total yield (tons per acre)	Yield of ware (tons per acre)	Percentage ware
Ulster Monarch ...	18·4	17·5	95
Eclipse	16·5	15·0	91
British Queen	15·9	14·5	91

Ulster Monarch significantly outyielded British Queen and Eclipse.

General.

In the opinion of the Committee, the shape—a uniform kidney free from second-growth—the heavy yield and desirable cooking quality of Ulster Monarch as shown by numerous private tests indicated that it was one of the most promising varieties entered for the trials since their inception. All the evidence pointed to the fact that Ulster Monarch could be used either as a late first-early or left and dug as a late second-early. It was considered a desirable substitute for Eclipse, British Queen and to some extent Majestic.

It was discovered, however, on examining the clamped produce of the trial at the beginning of October that the tubers of Ulster Monarch were severely affected with spraing and internal rust spot. The control varieties British Queen and Eclipse were also found to be affected but not so severely. By the end of November the percentage of affected tubers of Ulster Monarch was approximately 90 per cent. and by that time British Queen was equally severely affected. Eclipse showed a slightly lower percentage of affected tubers.

In view of this defect the Lancashire members of the Committee felt that it would be unsafe to make an award without further experience of the behaviour of the variety, and resolved that the variety should be allowed to be entered again in 1937 without payment of fee.

The members representing the Institute on the other hand thought that so little was known about the defect that it would be unreasonable to withhold an award merely because it developed extensively in a single trial.

The dispute was accordingly referred to the special sub-committee of the Gold Medal Committee which meets when the decision of the Committee is not unanimous and is presided over by an independent chairman appointed by the Ministry of Agriculture. The Committee decided that Ulster Monarch should be grown in six different places in England (including Ormskirk) in 1937, and from each centre 100 tubers should be selected and sent to the Institute at Cambridge, where they would be examined by an officer of the Ministry of Agriculture. If the defect should be found to be "substantially present" no award would be made; if the defect was "substantially absent" the award would follow automatically.

DESCRIPTION OF ULSTER MONARCH.

Sprout : Blue.
Tuber : Kidney; skin white; flesh white; eyes shallow; stolons short.
Foliage : Medium height, strong, bushy; leaf arched; leaflets large, dark green, waxy appearance; secondary leaflets small and few; wings of stems slightly crinkled; stems slightly pigmented.
Flowers : White.
Maturity : Second Early.

EARLY MAINCROP TRIAL.

ARRAN PEAK (D. MacKelvie).

Arran Peak was tested in the 1935 Gold Medal trials as seedling 193/63. Owing to the weather conditions in that year the foliage of the variety was destroyed prematurely and its cropping powers could not be judged, but in view of the fact that the yield results obtained under adverse conditions were remarkably good, the Committee decided to allow the variety to be re-entered for test in 1936 without payment of fee.

The trial was planted on the 7th April when the tubers of all stocks were slightly sprouted. The control varieties used were Majestic and Up-to-Date, the latter being stock seed as was the seed of Arran Peak. The Majestic was a first-class commercial stock.

The trial grew vigorously, even luxuriantly. The stocks of Arran Peak and Up-to-Date were ostensibly virus-free; two plants showing severe mosaic were present in the Majestic stock. The haulm of Arran Peak is of a desirable commercial type for a maincrop variety.

Blight (*Phytophthora infestans*) which made its appearance in the second week of August did not spread with any rapidity but ultimately hastened the destruction of the foliage.

Arran Peak matures normally about the third week in September and thus is a little later than Majestic, and somewhat earlier than Up-to-Date.

On lifting the trial only occasional tubers were found to be affected with blight. The weights given are those of sound tubers.

YIELD.

SUMMARY OF RESULTS (ware dressed $1\frac{5}{8}$").

	Tons per acre Total yield	Ware	Percentage ware
Arran Peak	16·0	14·7	92
	16·0	15·0	94
Majestic	14·9	13·6	92

The yields from the plots in this trial were irregular and lacked statistical significance.

General.

The yield obtained from Arran Peak was extremely good, a uniform crop of oval shaped tubers somewhat resembling Up-to-Date being obtained. No second-growth occurred in either of these varieties but a considerable amount of cracking and tuber malformation was present in the Majestic produce.

In view of its excellent crop and satisfactory cooking quality when grown at Ormskirk, the Lancashire members of the Committee were unanimous in wishing to make an award to Arran Peak. Members representing the Institute, however, disputed an award as they considered the cooking quality of the produce obtained from trials of this variety at different centres, including Ormskirk, to be unsatisfactory. When the findings of the Committee are not unanimous, the awards are referred to a special Sub-Committee which meets in London under an independent chairman appointed by the Ministry of Agriculture. The finding of this Committee was that on the evidence before them they were unable to recommend an award.

DESCRIPTION OF ARRAN PEAK.

Sprout : Blue.

Tuber : Oval; skin white with slight tinge of colour at heel; flesh white; eyes shallow; stolons with slight tinge of colour.

Foliage: Medium height, strong; colour dark green; intermediate leaf, arched; leaflets medium size, wrinkled; wings serrated; stems with deep purple colouration.

Flowers: White, numerous; stalks slender; buds coloured; anthers deep orange.

Maturity : Early maincrop.

MAINCROP TRIAL.

REDSKIN : DUNBAR STANDARD : DUKE OF KENT.

The control varieties used were Kerr's Pink, Majestic, Arran Consul and Up-to-Date. The trial was planted on the 9th April; all varieties with the exception of Duke of Kent were slightly sprouted. The trial grew vigorously.

Redskin, Kerr's Pink, Arran Consul and Up-to-Date were ostensibly virus-free, all being grown from stock seeds. The Majestic was a first-class commercial stock and showed no trace of virus diseases. Dunbar Standard showed two plants affected with secondary leaf-roll; Duke of Kent was ostensibly virus-free but a high percentage of misses were recorded, and the growth of this stock was very irregular.

Blight (*Phytophthora infestans*) which made its appearance in the second week of August did not spread with any rapidity but ultimately hastened the destruction of the foliage.

Judging by the surplus plots, which were sprayed with a strong solution of a proprietary preparation known to be efficacious when used at high concentrations, Redskin was three weeks earlier in maturing than Kerr's Pink and a week later than Majestic; there was no difference between the times of maturity of Kerr's Pink and Dunbar Standard, and Duke of Kent was some two weeks earlier than Kerr's Pink.

The foliage of Redskin was of medium height and afforded good cover, that of Dunbar Standard was tall, upright and vigorous, both being of a desirable type, whilst that of Duke of Kent was strong and bushy and was considered to be the ideal commercial haulm.

Yield.

Lifting took place between the 7th and 21st September.

Only occasional tubers were found to be affected with blight and the weights given are those of the sound produce.

SUMMARY OF RESULTS (ware dressed 1⅝").

	Tons per acre Total yield	Ware	Percentage ware
Dunbar Standard ...	18·1	16·7	93
Up-to-Date	17·4	16·3	94
Kerr's Pink	17·4	15·9	92
Redskin	16·7	15·7	94
Majestic	15·5	14·2	92
Arran Consul	12·7	12·3	97
Duke of Kent	10·8	10·2	95

Owing to irregularities in the yields of plots of certain varieties, and in particular of Up-to-Date, the differences cannot be said to be significant statistically. If, however, the plots of Up-to-Date are discarded, the following differences become significant both as regards total yield and yield of ware :—

Duke of Kent was outyielded by all the other varieties.

Dunbar Standard outyielded Arran Consul and Majestic.

Redskin outyielded Arran Consul.

General.

Redskin.—In the opinion of the Committee the produce of Redskin was more attractive than that of Kerr's Pink, the tubers being more uniform in shape and size, with shallow to medium eyes, as opposed to medium to deep in Kerr's Pink; second-growth was absent, a very desirable characteristic as one of the main faults of the latter variety is its proneness to second-growth. Its earlier maturity was also considered to be a practical advantage.

The expert report received from Messrs. J. Lyons & Co. Ltd. stated that its cooking quality was satisfactory and this was amply confirmed by a number of private reports.

As there is a popular demand in many parts of Great Britain for a red-skinned round variety, as shown by the large acreage planted with Kerr's Pink each year, the Committee felt that there is a definite place for Redskin on the market, and unanimously decided to award a Gold Medal to this variety.

Dunbar Standard.—The Committee were very impressed with the yield of this variety and with the shape of the tubers, which are oval with shallow eyes and remarkably uniform.

The expert report stated that the cooking qualities were good, being equal to King Edward when fried and steamed, whilst in all cases the private cooking reports gave the quality of this variety as outstanding.

The Committee had no hesitation in unanimously awarding a Gold Medal to this variety.

Duke of Kent.—This variety was tested in the 1935 Gold Medal trials in which year the cooking tests were not satisfactory, discolouration on boiling being pronounced. In view of the variety's other excellent characteristics and to find out whether the cooking effect was varietal or due to Ormskirk conditions, it was allowed in the 1936 trials without payment of fee. This year the variety was also grown in the Lincolnshire fens and Norfolk. Cooking tests carried out this year on the produce of the three centres again showed marked discolouration after boiling. The Committee therefore decided to make no award.

DESCRIPTION OF VARIETIES.

Redskin.

Sprout : Pink.

Tuber : Round ; skin pink ; flesh white to pale lemon ; eyes shallow.

Foliage : Upright, medium height, moderately vigorous ; leaf open, midrib tinged red-purple at bases of leaflet stalks ; leaflets dark green, dull and small ; stems mottled red-purple.

Flower : White, slight colouration on under-surface.

Maturity : Early maincrop.

Dunbar Standard.

Sprout : Pink.

Tuber : Oval to kidney ; skin white ; flesh white ; eyes shallow.

Foliage : Tall, strong, vigorous, open, upright ; colour dark green ; leaf close, short, erect ; leaflets large and pointed, hard, wrinkled ; secondary leaflets large and numerous ; wings slightly crinkled ; stems strong with slight colouration.

Flower : White, numerous ; anthers pale and loose.

Maturity : Late maincrop.

Duke of Kent.

Sprout : Pink.

Tuber : Round ; skin white ; flesh white ; eyes medium.

Foliage : Tall, strong, bushy ; colour dark green ; leaf open, arched ; leaflets large and waxy appearance ; secondary leaflets large ; wings crinkled ; stems green.

Flower : White, numerous ; green buds, orange anthers.

Maturity : Late maincrop.

THE LORD DERBY GOLD MEDAL AWARDS.

H. BRYAN, B.Sc.

In view of the interest the awards create it is thought that a brief survey of those made since their institution will be of value to potato growers and breeders.

The awards were originally made by the Ormskirk Potato Society which consisted of a number of south-west Lancashire growers who were interested in the work of the potato trials which began at Ormskirk in 1915, and were given to outstanding new immune varieties of promise which emerged from the trials.

In 1925 the Ormskirk Potato Society was dissolved and since then the awards have been made by the Lord Derby Gold Medal Committee, which with the Earl of Derby as its President, consists of a number of prominent south-west Lancashire growers with three members representing the National Institute of Agricultural Botany. An innovation was made in charging a fee of £5 per entry to pay in part the cost of the trials and also to discourage frivolous entries.

A Gold Medal award should be looked upon as an indication that the Committee regard the varieties as being likely either to satisfy requirements left unsatisfied by those already established in public favour, or which show signs of superiority in one direction or another over varieties at present in cultivation.

The Committee realise in coming to their decisions that they are attempting to forestall experience, and are aware that the all important feature of the varieties' reaction to the many kinds and combinations of virus diseases, on which the variety's commercial future largely depends, cannot be gauged in the early stages of the life history of a new seedling. How far their judgment has been vindicated can only be determined by the fate in commerce of the varieties receiving the award.

From 1925 to 1936, during which time the awards were made by the Lord Derby Gold Medal Committee, forty-eight varieties were tested (seven of them twice) and eleven awards made.

The following list gives the name or number of all varieties entered for the trials during that time. With the exception of Doon Star no new variety, other than those awarded Gold Medals, has achieved any commercial success during this period. In the case of the later awards allowance should be made for the fact that it usually takes from four to six years for a new variety to become established. The word " extinct " implies that the varieties are not listed in potato seedmen's catalogues and as far as is known are not on the market.

LORD DERBY GOLD MEDAL TRIAL ENTRIES 1925-1936.

Year of Test	Variety	Committee's decision	Fate in commerce
1925	Arran Consul	awarded GOLD MEDAL	1934. 3,565 acres grown in Great Britain 1935. 2,697 ,, ,, ,, ,, ,, 1936. 2,322 ,, ,, ,, ,, ,, not being widely grown owing to its susceptibility to virus diseases.
,,	Oran Beauty	no award	extinct
,,	Glenalmond	no award	extinct
,,	Keay's Champion	no award	extinct
1926	Sefton Wonder	no award	grown for exhibition purposes
,,	The Mac	no award	extinct
,,	Perth Favourite	no award	extinct
,,	Glasgow Favourite	no award	garden potato, not grown commercially
1927	Arran Banner	awarded GOLD MEDAL	1934. 15,167 acres grown in Great Britain 1935. 19,850 ,, ,, ,, ,, ,, 1936. 25,066 ,, ,, ,, ,, ,, firmly established
,,	Aberdeen Favourite	no award	extinct
,,	Macbeth's Castle	further trial	garden potato, not grown commercially
	Baron	further trial	offered by one or two seedsmen only, not grown commercially
,,	Doon Star	no award (offer of a further year's trial refused by the raiser)	1934. 1,949 acres grown in Great Britain 1935. 4,302 ,, ,, ,, ,, ,, 1936. 8,918 ,, ,, ,, ,, ,,
,,	Claymore	further trial	garden potato, not grown commercially
,,	Incomer	further trial	extinct
,,	Bounty	no award	extinct
,,	Argyll Favourite	no award	extinct
,,	Duke of Perth	no award	garden potato, not grown commercially
,,	Boxer	no award	extinct
1928	Arran Crest	awarded GOLD MEDAL	1934. 228 acres grown in Great Britain 1935. 287 ,, ,, ,, ,, ,, 1936. 238 ,, ,, ,, ,, ,, reason not grown—susceptibility to leaf-roll
,,	Seedling 440 (MacKelvie)	no award	extinct
,,	Electron	no award	extinct
,,	Inverness Favourite	no award	garden potato, not grown commercially
,,	Cherry	no award	extinct
,,	Macbeth's Castle	no award	see 1927
,,	Baron	no award	see 1927
,,	Claymore	no award	see 1927
,,	Incomer	no award	see 1927
1929	Medland	no award	extinct
,,	Alannah	no award	extinct
,,	Seedling 675 (MacKelvie)	no award	extinct
,,	Forerunner	no award	extinct
1930	Glenshee	no award	not grown commercially

Year of Test	Variety	Committee's decision	Fate in commerce
1931	Arran Pilot	awarded GOLD MEDAL	1934. 849 acres grown in Great Britain 1935. 2,519 ,, ,, ,, ,, ,, 1936. 4,181 ,, ,, ,, ,, ,, established
,,	Arran Scout	no award	garden potato, not grown commercially
,,	Ballydoon	further trial	small acreage—not yet established
1932	Arran Cairn	awarded GOLD MEDAL	small acreage—not yet established
,,	Doon Pearl	awarded GOLD MEDAL	small acreage—not yet established
,,	Ballydoon	no award	see 1931
,,	Cumnock	no award	extinct
1933	Manifold	no award	extinct
,,	Asset	no award	extinct
,,	Seedling 159/11 (MacKelvie)	no award	extinct
1934	Seedling 4276 (McGill & Smith)	no award	extinct
,,	Arran Signet	awarded GOLD MEDAL	
1935	Gladstone	awarded GOLD MEDAL	1936. 476 acres grown in Great Britain
,,	Alness	no award	
,,	Arran Peak	further trial	
,,	Duke of Kent	further trial	
1936	Doon Early	awarded GOLD MEDAL	
,,	Redskin	awarded GOLD MEDAL	
,,	Dunbar Standard	awarded GOLD MEDAL	
,,	Arran Peak	no award	
,,	Duke of Kent	no award	
,,	Ulster Monarch	further trial	

THE IMPORTANCE OF HEALTHY SEED IN POTATO CULTURE.*

H. BRYAN, B.Sc.

The main factor in successful potato culture — provided the land is suitable for its purpose and uninfested with potato eelworm — is the use of virus-free seed of the most desirable varieties. Compared with these factors, cultivations and manuring are matters of secondary consideration; plants affected with virus diseases do not respond to costly cultivations or manurial treatments.

The discovery of the causes of degeneration of the potato, the realisation that varieties do not perish from senile decay but through contamination with plant viruses, which are spread mainly if not entirely by green-fly, and the fact that such knowledge can be put to practical use and advantage is surely a happening of the first importance in the potato world. As the potato can reproduce itself asexually indefinitely without deterioration so long as virus infection is absent, and as probably only one species of green-fly (*Myzus persicae*) is responsible for the dissemination of virus diseases in the field, it would appear that clean stocks could only be raised in those districts where this particular green-fly is absent or where its numbers are very small. On this basis one would assume it to be impossible to raise healthy seed in south-west Lancashire, where the aphis population is known to be high. The purpose of this paper is to show that this idea is fallacious.

Blight in some years may occasion heavy loss of the saleable crop but planting seed badly infected with virus diseases produces the same result. English potato growers frequently obtain fresh supplies of seed from Scotland or other northern sources, enough seed being obtained each year to plant a quarter of the total acreage grown. Experience has shown that such seed, when more than once-grown in the milder climate of England, loses much of its productivity owing to the prevalence of crop-reducing virus diseases, such as leaf-roll, mosaic, crinkle and streak, and such diseases are prevalent to a greater or less degree in all crops of potatoes grown from ordinary English seed.

Under normal farming conditions contamination with viruses occurs to a greater or lesser degree in the first year the fresh seed is grown in England, this contamination taking place through growing imported seed alongside crops grown from virus infected English seed. The distribution of infection depends on the proximity of such infected stocks and on the number of winged *Myzus persicae* visiting the fresh stocks from the infected stocks. The movement of the insect vectors is largely governed by the weather; hot, dry windy weather greatly facilitating their distribution and a wet rainy season impeding it.

When it is realised that approximately half-a-million acres of potatoes are grown annually in England and Wales and that roughly only 120,000 tons of seed are imported each year from Scotland and Ireland, that is, enough to plant 120,000 acres, it is seen that some 380,000 acres are planted with English grown seed of unknown health.

*** From an address to Section M of the British Association delivered at Blackpool on the 15th September, 1936.**

The loss caused to growers by planting such seed must be enormous and there is evidence that it could to a great extent be avoided. In any case, it is interesting to know that England is the greatest seed potato producing country in Great Britain or, perhaps it would be more accurate to say, that more potato tubers are saved for seed than in any other country in Great Britain.

If these 380,000 acres were planted with healthy seed it is not too much to assume that the national output would be increased by at least a ton an acre — a modest estimate.

The problem which arises is how this seed is to be obtained unless the grower purchases fresh supplies each year from the best seed producing areas in the northern latitudes. The suggestion is made that the farmer should attempt to grow his own.

In 1929 experiments were begun at Ormskirk to find out whether the health of imported stocks could be maintained in south-west Lancashire and so avoid the necessity of the constant purchase of fresh seed. The plots were grown on the farm at Ormskirk where the potato trials of the National Institute of Agricultural Botany are carried out; that is, in the centre of one of the great ware potato producing districts in England, where every chance of virus infection is present.

The method adopted was to grow plots of healthy potatoes isolated from other potatoes by a distance of not less than 60 yards. The isolation used in the experiment was only relative and such as could be done by the practical man. There was no intention, neither was there the facility, to practice true isolation by growing plants under insect-proof conditions. By this means, Arran Consul, a late variety highly susceptible to virus diseases and more especially to leaf-roll was kept virtually free from virus infection over a period of five years. The only precaution taken was to rogue out any suspicious looking plants from the plot, and not more than 2 per cent. of the plants were removed in any single year.

In the sixth year a yield trial of the produce of the isolated plot of Arran Consul was carried out against the best Scotch seed obtainable. The trial consisted of eight randomised single drill plots of each stock. Unfortunately, it was not possible to obtain any yield results owing to the haulms of the potatoes being destroyed by a succession of severe gales in the middle of the growing season, but no differences could be detected between the vigour and health of the two stocks whilst growing.

The striking growth obtained from the experimental plots was considered encouraging enough to carry out trials on the field scale on ordinary commercial potato farms in Lancashire. A further inducement to attempt such trials was the susceptibility to virus diseases of a new early variety, Arran Pilot, which had just come on the market, and which otherwise was of outstanding merit. It was found that, under ordinary farming conditions, once-grown seed of this variety produced plants which showed 50 per cent. to 100 per cent. virus infection with a corresponding loss of crop. Such an excellent variety, the outcome of years of patient work by one of Scotland's foremost potato breeders, was obviously worthy of further consideration. Accordingly, enough Scotch stock seed to plant half-acre plots was supplied to individual farmers in 1934. Stock seed is seed certified by the Scottish Department of Agriculture to be of an exceptionally high standard of purity in the growing

state and apparently free from disease. The only stipulation made to the farmer was that the crops must be grown at least 60 yards away from any other stocks, the health of which was not known.

The crops were carefully examined on numerous occasions whilst growing and, as was expected during the first year (1934), no virus infected plants were seen. The produce was lifted and boxed by the growers during the third week of July when the plants were still immature, in accordance with the commercial practice of the district. The tubers were stored in clean sprouting sheds or glasshouses, the growers being warned that virus diseases could be spread by green-fly in the sprouting shed as well as in the field. Seven or eight cwt. of this seed was reserved for further isolated seed plots; the remainder was duly planted the following year (1935) for the production of ware, with results as surprising and gratifying as those obtained from the experimental plots. Each farmer was able to plant six or seven acres. Growth was vigorous and virus infected plants were not found to a higher degree than 2 per cent.

Heavy crops were obtained, 12 tons per acre being lifted in the middle of July. These are not relative but actual weights.

The produce from the seed plots in the second year, that is in 1935, was treated in exactly the same way as in the preceding year and the same results were obtained in the third year (1936), namely, virtual absence of virus diseases and heavy yields.

One grower, satisfied with the result of the initial experiment, carried the scheme a stage further last year and planted 8 acres of stock seed of five varieties in one field. The stocks were not isolated from each other in any way, but were isolated from all other potatoes. Amongst the varieties planted was Dunbar Cavalier, a fairly recent introduction which, three or four years ago, was grown to the extent of 2,000 acres in Scotland but has now dropped to 200 acres, mainly because of its extreme susceptibility to virus diseases. This variety produced enough seed to grow four acres this year. A very careful examination of the growing plants showed that virus infection was not present to the extent of more than 2 per cent.

These facts tend to show that the problem of seed production in England is not a very complicated affair.

No yield trials of isolated and non-isolated seed are available. The established fact that growers invariably obtain fresh seed every year of the varieties mentioned in this paper owing to their susceptibility to virus when grown under ordinary commercial conditions and the fact that the same stocks when isolated can be grown on the field scale without loss of crop for some years, is sound enough evidence without the introduction of yield trial figures.

The main essentials for success are simple, and are—

(1) the original stock should consist of the best seed obtainable;
(2) it must be grown at least 60 yards from other potatoes whose health is not known;
(3) suspicious plants must be rogued out at the earliest possible stage;
(4) the ground on which the seed is planted must be free from groundkeepers, that is, potatoes left in the ground from a previous crop.

It is believed that this paper describes for the first time experiments showing that isolation for seed purposes, in an important ware producing district, can be carried out on the field scale in England with success.

Theoretically, this method of maintaining healthy seed in England may appear fantastic, but if the scheme is successful with highly susceptible varieties in hot dry years like 1934-35 in south-west Lancashire, one may surely be justified in assuming that it will be equally successful elsewhere.

The scheme would perhaps apply mainly to small potato growers. Of 50,000 growers of more than 1 acre in England and Wales, 30,000 grow less than 5 acres, and 10,000 grow less than 10 acres each year. One-half to one acre devoted by each to seed production would suffice for their yearly needs.

SUMMARY.

To a great extent the English grower can, by isolation and rogueing, guarantee the health of the seed he saves. This fact is of importance when it is realised that three-quarters of the acreage of potatoes in this country are planted with tubers saved from crops grown under ordinary farming conditions, no precautions being taken against the inevitable virus infection.

Growing potatoes for seed is an entirely different matter from growing potatoes for the market and requires some slight knowledge of plant diseases, how they occur and how they are spread.

In the usual course of things additional knowledge means some dislocation of established practices and this will no doubt be the case with seed potato production in England, when the infectious nature of virus diseases is more widely understood.

The present haphazard method of saving seed should hold no place in intelligent potato culture.

POTATO TRIALS 1936.

B. BRANDRETH, B.A. AND H. BRYAN, B.Sc.

I. THE EFFECT OF SIZE OF " SEED " ON THE YIELDS OF THE LARGER GRADES OF WARE POTATOES.

INTRODUCTION.

The investigation under review was carried out in 1936 and was a continuation of the work commenced in 1934(1). A trial which was grown in 1935 had to be discarded owing to the effects of gales on the crop, and it was decided to use Kerr's Pink in 1936, since Majestic, the variety previously tested, was particularly susceptible to wind damage.

The trial was carried out at Ormskirk on a light sandy loam, Scotch stock seed of Kerr's Pink being used. It was hoped to obtain seed of the same size as in the 1934 trial, but the sizes actually used were 6 oz., 2 oz. and 1 oz., the classes of seed tested being as follows :—

Large, halved,	with an average weight of	3 oz.
Medium,	,, ,, ,, ,, ,,	2 oz.
Small,	,, ,, ,, ,, ,,	1 oz.
Medium, halved,	,, ,, ,, ,, ,,	1 oz.
Large, quartered,	,, ,, ,, ,, ,,	1½ oz.

The seed was boxed on the 12th February, and was cut longitudinally, where necessary, at the time of planting on the 8th April. The trial consisted of eight blocks each containing a randomized single drill plot planted with each class of seed. The drills were 28 inches apart and contained 70 setts planted at a distance of 16 inches.

The previous crop was one of seeds hay; farmyard manure was applied in the drills at planting time at 16 - 18 tons per acre, as also was a dressing of 3 cwt. per acre of a concentrated potato fertilizer having the following analysis :—

Soluble phosphate	15·1 per cent.
Potash	48·5 ,, ,,
Nitrogen (as sulphate of ammonia) ...	20·6 ,, ,,

Growth was vigorous, and neither secondary nor current season destructive virus symptoms were observed. There were very few misses, there being one each in the 6 oz. seed halved and 2 oz. whole, four in the 6 oz. quartered, two in the 2 oz. halved, and none in the 1 oz. seed planted whole.

The plots matured on the 22nd September, and the produce was lifted and weighed on the 29th September; the riddles used were $1\frac{5}{8}$ inches, $1\frac{3}{4}$ inches and $1\frac{7}{8}$ inches.

YIELD PER ACRE.

Table I.

TOTAL YIELD AND YIELD OF WARE

(tons per acre)

Seed.	Total yield	Ware yield.		
		Over $1\frac{5}{8}''$	Over $1\frac{3}{4}''$	Over $1\frac{7}{8}''$
6 oz. tubers in halves ...	15·8	14·7	14·0	11·8
2 oz. tubers	15·4	14·1	13·3	11·6
1 oz. tubers	13·8	13·1	12·6	11·3
2 oz. tubers in halves ...	14·6	13·7	13·2	11·9
6 oz. tubers in quarters ...	14·2	13·5	13·0	11·8
Standard error ...	0·26	0·27	0·24	—
Significant difference ...	0·9	0·9	0·8	—

Total Yield. Large halved seed outyielded all classes except medium whole, and the latter outyielded the small whole and large quartered seed.

Ware over $1\frac{5}{8}''$. Large halved seed outyielded all classes except medium, the latter outyielding the small seed only.

Ware over $1\frac{3}{4}''$. Large halved seed again outyielded all classes except medium whole seed; there was no other significant difference between the yields.

Ware over $1\frac{7}{8}''$. There were no significant differences between the yields.

PROPORTION OF WARE PRODUCE.

Table II shows the proportion of the different grades of ware produced by the various seed sizes. Differences are slight, but it will be noted that the large halved and medium whole seed produced a smaller percentage of large ware than the other sizes. It is this factor which reduces the yields of the largest grade of ware to a common level.

Table II.

PROPORTION OF WARE POTATOES.

Seed.	Percentage of ware.		
	Over $1\frac{5}{8}''$	Over $1\frac{3}{4}''$	Over $1\frac{7}{8}''$
6 oz. tubers in halves ...	93	89	75
2 oz. tubers	91	87	76
1 oz. tubers	95	91	82
2 oz. tubers in halves ...	94	91	81
6 oz. tubers in quarters ...	95	92	83

COMMERCIAL VALUE OF CROP.

Tables III A, B and C show the relative returns to the grower from the various classes of seed.

Table III A.

VALUE OF CROP.

(Ware dressed $1\frac{5}{8}''$).

Seed.	Cost of seed	Value of ware	Value of surplus	Net value of total crop	Net value of ware
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
6 oz. tubers in halves ...	5 17 0	51 9 0	1 2 0	46 14 0	45 12 0
2 oz. tubers	5 9 2	49 7 0	1 6 0	45 3 10	43 17 10
1 oz. tubers	3 6 4	45 17 0	0 14 0	43 4 8	42 10 8
2 oz. tubers in halves ...	2 14 7	47 19 0	0 18 0	46 2 5	45 4 5
6 oz. tubers in quarters	2 19 0	47 5 0	0 14 0	45 0 0	44 6 0

Table III B.

VALUE OF CROP

(Ware dressed $1\frac{3}{4}''$).

Seed.	Cost of seed	Value of ware	Value of surplus	Net value of total crop	Net value of ware
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
6 oz. tubers in halves	5 17 0	49 0 0	1 16 0	44 19 0	43 3 0
2 oz. tubers ..	5 9 2	46 11 0	2 2 0	43 3 10	41 1 10
1 oz. tubers	3 6 4	44 2 0	1 4 0	41 19 8	40 15 8
2 oz. tubers in halves ..	2 14 7	46 4 0	1 8 0	44 17 5	43 9 5
6 oz. tubers in quarters	2 19 0	45 10 0	1 4 0	43 15 0	42 11 0

Table III C.

VALUE OF CROP.

(Ware dressed $1\frac{7}{8}''$).

Seed.	Cost of seed	Value of ware	Value of surplus	Net value of total crop	Net value of ware
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
6 oz. tubers in halves ...	5 17 0	41 6 0	4 0 0	39 9 0	35 9 0
2 oz. tubers	5 9 2	40 12 0	3 16 0	38 18 10	35 2 10
1 oz. tubers	3 6 4	39 11 0	2 10 0	38 14 8	36 4 8
2 oz. tubers in halves ...	2 14 7	41 13 0	2 14 0	41 12 5	38 18 5
6 oz. tubers in quarters	2 19 0	41 6 0	2 8 0	40 15 0	38 7 0

In order to obtain these figures, the seed was charged at £5, £7 and £8 10s. 0d. per ton for the 6 oz., 2 oz., and 1 oz. grades respectively. The weights of seed planted per acre were as follows :—

Large halved seed	... ...	1·17 tons
Medium seed	... ...	0·78 ,,
Small seed ...	... ...	0·39 ,,
Medium halved seed	... ...	0·39 ,,
Large quartered seed	... ...	0·59 ,,

It has been assumed that the crop is sold for ware only and that the surplus produce was used for feeding stock. The ware has been given an arbitrary value of 70/- per ton and the surplus £1 per ton.

Differences between the cash returns were small. Large and medium halved seed generally gave the best return, but where the produce was dressed over a 1⅞ inch riddle the large halved seed was inferior to both the small halved and large quartered seed.

SUMMARY.

The crops of Kerr's Pink potatoes produced by five classes of seed were compared. Three sizes of seed tubers were planted, the largest being halved and quartered and the medium size halved. The two smaller sizes were also planted whole.

Large halved tubers weighing 3 oz. produced the heaviest yields of ware but were closely followed by whole tubers averaging 2 oz. in weight. The differences became progressively less marked as the size of riddle over which the ware was dressed was increased.

Large and medium halved seed generally gave the best cash return to the grower.

In a previous trial carried out with the variety Majestic in 1934, whole tubers averaging 2½ oz. in weight gave the highest yields and the best cash return, and it seems likely that, had the same grades of seed been used in the 1936 trial, the results would have been similar.

REFERENCE.

(1) Brandreth, B. Potato Trials, 1934-1935. Journ. Nat. Inst. Agric. Bot., 1935, **4**, 64.

II. STOCK SEED TRIAL.

Under the Ministry of Agriculture and Fisheries Seeds (Amendment) Regulations 1935, potato crops grown under special conditions for seed production in England and Wales may now be classed as Class 1 (Special Stock)

Although the new classification did not come into force until 1936, stocks of Majestic of the desired standard were available from Cumberland and Wales for trial in that year and seed from these two districts was compared with stocks supplied by the Ministry of Agriculture for Northern Ireland, the Irish Free State Department of Agriculture, an Isle of Man stock and Aberdeenshire stock seed.

The trial consisted of eight randomized single drill plots of each stock. The drills were drawn 28 inches apart and consisted of 70 whole setts with 16 inch spacing. A large single plot of each stock was planted for demonstration purposes.

With the exception of that from the Isle of Man, the condition of the seed from all sources was extremely good, although the size of the tubers was rather variable. In the case of the Manx seed there were many damaged tubers and a high percentage of dry-rot was present.

The trial was planted on the 14th April, the tubers of all stocks being slightly sprouted. The growth of the Manx stock was extremely poor but no difference could be detected in the vigour of growth of the other stocks.

No misses occurred in the Scottish, the Irish Free State and the Cumberland plots. Two misses occurred in the Northern Irish stock, 20 (3·4 per cent.) in the Welsh, and 47 (8·4 per cent.) in the Manx stock.

The Scottish, Irish, Welsh and Cumberland stocks were ostensibly virus-free.

The Manx stock showed 11 plants (2·0 per cent.) of secondary leaf-roll and 17 plants (3·3 per cent.) of severe mosaic.

Two plants affected with Blackleg were noted in the Welsh plots.

The trial did not mature normally owing to an attack of blight (*Phytophthora infestans*) which first appeared during the second week in August, but with the exception of that from the Isle of Man, all stocks appeared to be equally affected. Despite the prolonged attack and the favourable conditions for infection, only occasional tubers were found to be affected on lifting and the weights given are those of the sound produce.

The Manx stock was judged to be mature on the 28th August and the remainder of the stocks on the 1st September. The trial was lifted and weighed during the second week in September, the table below showing the weights of sound produce.

YIELD.

	Total yield (tons per acre)	Yield of ware (tons per acre)	Percentage of ware
Scottish	17·3	15·0	87
Irish Free State	17·0	14·3	84
Northern Irish	16·5	13·2	80
Welsh	15·5	13·0	84
Cumberland	15·4	12·5	81
Isle of Man	10·7	8·4	78
Significant difference	1·0	1·1	—

The yields of ware from the Scottish and Irish Free State stocks did not differ significantly but both significantly outyielded the remainder. The Isle of Man stock was significantly outyielded by all others, as was expected. It was thought also that the somewhat high percentage of misses in the Welsh plots would have an adverse effect on their yield.

The significant differences which occurred in the yields of the Irish, Scottish and Cumberland stocks were not indicated by the vigour or appearance of the plants whilst growing, and the reason for such differences may have to be sought in the origin of the stocks, as distinct from any manifestations of virus symptoms.

III. GLADSTONE v. KING EDWARD.

Gladstone, an early maincrop variety with tubers resembling King Edward in colouring and shape, was awarded a Lord Derby Gold Medal in 1935. In 1936 it was compared with King Edward in a trial at Ormskirk.

Stock seed of each of the varieties was ordered from the same farm in Aberdeenshire, and was received and boxed in the second week of February. The seed was noted as very good and in both varieties averaged five tubers to the lb.

The trial was planted on the 8th April when the sprouts were ¼″ to ½″ long, and consisted of eight randomized drill plots of each stock with seventy whole setts per plot.

The growth was uniform and extremely vigorous, and as was expected, no secondary virus symptoms were seen and no destructive current season virus occurred. There were no misses.

By the end of July the trial was a tangled mass of foliage and it was difficult to distinguish the stocks. Blight appeared during the second week of August and hastened the death of the haulms, but Gladstone appeared to be more resistant to blight than King Edward and matured a week later. On lifting only isolated tubers were found to be affected with blight and the weights given are those of sound tubers.

YIELD.

SUMMARY OF RESULTS (ware dressed 1⅝″).

	Total yield (tons per acre)	Yield of ware (tons per acre)	Percentage of ware
Gladstone ...	15·3	14·1	92·1
King Edward ...	15·4	13·6	88·5

The relative yields varied too greatly for a useful standard error to be calculated.

GENERAL.

The sample of Gladstone was considered to be more desirable than that of King Edward, the individual tubers were larger and there was no pointing at the heel, a characteristic of the latter variety.

On cutting tubers from the surplus plots of Gladstone it was found that a certain percentage of them were hollow at the centre. An investigation of the crops of this variety grown on farms in the district, showed, unfortunately, that this defect was prevalent. It is hoped that the cause of this defect is seasonal, otherwise the commercial future of this variety must remain in doubt.

IV. ERSTELINGER, CAMBRIDGE, 1936.

The variety Erstelinger was listed as a synonym of Duke of York in 1924. In view, however, of the possibility of considerable imports of seed of the variety in 1936 it was decided to compare it with Duke of York in a yield trial at Cambridge in the same year.

The seed of Erstelinger was supplied by the importers. It proved to be a very rough sample, being uneven in size and with many tubers already having long sprouts on arrival. Tubers selected to average six per pound

were boxed on the 26th February on the same day as the seed of Duke of York, any long sprouts being rubbed off. The latter was a Scotch commercial stock and was noted as in excellent condition and even in size, averaging six tubers per pound.

The trial consisted of eight blocks, within each of which was arranged at random a single fifty-tuber row of each variety. The rows were 24½ inches apart and the setts 12 inches apart in the rows. Twelve loads per acre of farmyard manure were ploughed in during the winter, and a complete dressing of artificials was applied in the rows at planting time.

The soil was a gravelly loam over gravel and had carried a crop of wheat in the previous year. Planting was done on the 13th March, and subsequent development was normal, there being no difference in the appearance of the varieties. Erstelinger, however, commenced to yellow off during the first week in July, whereas Duke of York remained a deep green. At this stage also the foliage of Duke of York filled the rows, while that of Erstelinger was rather less vigorous.

Both were lifted on the 8th July, when it was seen that the produce of Duke of York was definitely the better sample, the whole of it being saleable. A number of small tubers were present in the Erstelinger produce, while the larger tubers were uneven in size. It is likely that this may have been largely due to the difference between the seed sizes of the varieties.

The yield differences were small and had no statistical significance, Duke of York producing 9·1 tons per acre of saleable tubers and Erstelinger 8·9 tons, with an additional 0·4 tons per acre of " smalls ".

The trial clearly showed that the varieties were identical.

V. VARIETY TRIALS, NORFOLK AND LINCOLNSHIRE, 1936.

During 1936, replicated trials of King Edward and Majestic potatoes were arranged at five centres in order to supply material for cooking quality tests. Two of these centres were near Southery on black fen soil and at Kirton Lindsey on a medium-heavy loam on the oolitic limestone formation. It was decided to extend these trials so as to include several recently introduced varieties and others about which information was desired.

The newer varieties were Arran Peak, Duke of Kent and Gladstone, which had been entered for the 1935 Lord Derby Gold Medal trials at Ormskirk. Doon Pearl and Doon Star were also included, as was Mons Star. This last had been listed as a synonym of King Edward, but as it was suggested that it was in some way superior to King Edward it was thought desirable to test it in a yield trial, and seed was accordingly obtained from Messrs. Robert Morris & Son Ltd., Coupar Angus, together with their own stock of King Edward.

Scottish seed was used and this averaged seven tubers to the pound, except for Arran Peak, whose seed had an average weight of nearly four ounces, and Mons Star and its control, which ran nine and ten to the pound. The condition of the seed was generally excellent, but that of Mons Star and its control was poor, many tubers weighing little more than one ounce and a considerable proportion being rotten.

Owing to the large size of the seed of Arran Peak, it was necessary to use a certain amount of cut seed, and in order that the conditions should

be similar throughout, in each trial two rows of every variety except Mons Star and its control were planted with cut seed, and four with whole seed. It is of interest that no differences in yield could be traced to the use of cut seed, the results from the blocks planted with whole seed being very similar to those planted with cut seed.

SOUTHERY.

Planting at Southery took place on the 24th March under good conditions. The previous crop had been sugar beet, which received farmyard manure and complete artificials. For the potatoes a dressing of ten loads of dung and 5 cwt. of superphosphate was applied in the rows at the time of planting.

The nine stocks were included in a single trial, consisting of six blocks within each of which were plots of each stock arranged at random. The plots consisted of single rows containing fifty setts spaced at 16½ inches, the rows being 29 inches apart. The trial area was completely open and was surrounded by a commercial crop of potatoes.

The setts were covered in on the same day and subsequent development of the plants was normal; although other potatoes in the field were affected by May frosts, the trial escaped and growth was notably vigorous in all varieties except Mons Star and its control, both of which were weaker than the other stock of King Edward. It was noted that the haulm of Arran Peak was of a particularly desirable type for the rich fen soils, the stout upstanding stem and broad foliage being of great value in suppressing weeds.

The number of misses was small, except in the case of Majestic and of Mons Star and its control stock of King Edward, which contained 3·5, 6·2 and 6·6 per cent. respectively. No symptoms of virus diseases were observed except in Mons Star and its control. These contained 3·5 and 2·4 per cent. of plants showing secondary Y virus symptoms. It is likely that any signs of current season Y virus which appeared after the end of July would be masked by the onset of Phytophthora.

Blight was prevalent throughout the district, and appeared in the trial on the 30th and 31st July, the haulm of King Edward being killed off by the 8th August. By the 27th August all were practically finished, apart from Duke of Kent, Doon Star and Gladstone. No spraying was carried out. A dense growth of weeds resulted from the loss of haulm, interfering to some extent with lifting. All of the plots were lifted on the 27th September using a spinner. Gladstone and Doon Star had still a certain amount of green top, nor were Duke of Kent and Majestic killed off quite as much as the other varieties, the tops of all of which were quite dead.

The produce of each variety was marked 0 - 4 for the proportion of blighted tubers present when lifted, as follows :—(0=no blight observed)

Majestic	0
King Edward	½
Mons Star	½
Duke of Kent	½
Doon Star	1
Doon Pearl	2
Doon Peak	2
Gladstone	3

It will be observed that several varieties whose tops were comparatively resistant showed severe tuber infection, possibly owing to the prolonged period during which spores were being carried down day by day to the soil. This was very marked in Gladstone and Doon Star; Majestic, however, produced no blighted tubers, in spite of the fact that its haulm remained green for a considerable time.

The produce was dressed over a 1½ inch riddle, and the total yield and yield of sound ware are given below, together with the proportion of ware sized tubers.

	Total yield (tons per acre)	Yield of ware (tons per acre)	Percentage of ware
King Edward	3·6	2·8	78
Majestic	8·6	8·1	94
Duke of Kent	10·5	10·0	95
Doon Pearl	5·4	5·1	94
Doon Star	6·9	6·4	93
Arran Peak	5·3	4·7	89
Gladstone	11·8	10·9	92
Mons Star	3·5	2·8	80
King Edward (control to Mons Star)	4·1	3·4	83

Significant difference between yields of ware = 1·1 tons per acre.

As regards yield of ware, there was no significant difference between Gladstone and Duke of Kent, both of which were superior to all other varieties. Majestic came next in order of yield, followed by Doon Star and Doon Pearl. All of the differences between these were large enough to be statistically significant. Arran Peak was similar in yield to Doon Pearl, both outyielding Mons Star and the two stocks of King Edward, which gave very small yields indeed.

The plots of Mons Star contained fourteen rogues with white skinned tubers, and the plots of the control stock of King Edward contained eight such plants. The results of the trial were a confirmation of the findings of the Potato Synonym Committee, for Mons Star proved to be a synonym of King Edward.

Kirton Lindsey.

The varieties tested at Kirton Lindsey were King Edward, Majestic, Arran Peak, Duke of Kent, Gladstone and Doon Star. The trial consisted of six blocks, each containing a plot of each variety arranged at random. The plots consisted of single rows of fifty tubers spaced at 17 inches, the rows being 28 inches apart. The trial area was completely open and the trial was surrounded by a commercial crop of potatoes.

The soil was a medium-heavy loam and the field was ley in the previous year. Ten to twelve loads of farmyard manure were spread and ploughed in with the ley, and at the time of planting the following amounts of artificials were applied in the rows :—

Sulphate of ammonia	2 cwt. per acre.
Sulphate of potash	2 ,, ,, ,,
Superphosphate	4 ,, ,, ,,
Steamed bone flour	½ ,, ,, ,,

Planting took place on the 8th April and subsequent development was normal, although much less vigorous than at Southery. No virus symptoms were observed, and the number of misses was very small. Blight made its appearance in mid August, and by the 1st September the tops of King Edward and Arran Peak had browned off. By the 11th September Doon Star had been killed off; when the plots were lifted on the 23rd September, Majestic and Duke of Kent showed a fair amount of green top, while Gladstone was still quite green.

The produce was dressed over 1½ inch riddles and any diseased tubers were removed. Gladstone had more tubers affected by blight than the other varieties, but the produce was generally much healthier than that from the trial at Southery.

The following table gives the yields of the different varieties :—

	Total yield (tons per acre)	Yield of ware (tons per acre)	Percentage of ware
King Edward	5·0	4·1	84
Majestic	9·7	9·2	95
Duke of Kent	9·1	8·2	91
Doon Star	6·9	5·9	86
Arran Peak	7·6	6·4	84
Gladstone	8·6	8·1	94

Significant difference between yields of ware = 1·6 tons per acre.

As in the fen trial, Majestic, Duke of Kent and Gladstone outyielded the other varieties, although here the difference between Majestic and Duke of Kent and Gladstone was reversed. Doon Star and Arran Peak gave similar yields, and both were superior to King Edward.

It was clear that the incidence of blight at both centres was such that the results of neither trial could be taken to represent the cropping capacities of the varieties in a blight-free year and the trials will be repeated in 1937.

POTATO QUALITY TRIALS, 1935 AND 1936.

B. BRANDRETH, B.A.

In 1931 a series of cooking tests was carried out on samples of several varieties of potatoes grown at different centres during that season. An account of the results obtained from these tests was published in this Journal for 1934(1). In 1935 it was decided to repeat the 1931 experiments, but to make certain modifications which the previous work had shown to be desirable, and here it may be mentioned that the repetition of the trials was made possible by the ready offer of Dr. Lampitt to undertake the actual cooking tests at Messrs. Lyons' Research Laboratories.

The object of the 1935 trials was to compare the cooking qualities of King Edward and Majestic potatoes when grown in five of the chief potato growing districts. The trials were repeated in 1936, the general arrangements for the two years being similar.

Scottish stock seed was obtained from a single source and was sent to each of the five centres, which were situated on the following soils :—

Innerwick	Dunbar red sandstone
Kirton Lindsey	Oolitic limestone
Kirton	Medium heavy silt
Ormskirk	Light sandy loam
Southery	Black fen

At each centre six rows of each variety were planted, the trials consisting of six blocks, each containing a pair of single row plots. The varieties were arranged at random within the blocks. Cultivations and manuring were in accordance with the usual practice of the growers on whose land the trials were situated, details being given in Table I.

The weather at the five centres during the two seasons was not abnormal. Records of rainfall and sunshine obtained from the nearest possible meteorological stations to each centre are included in Tables IIA and IIB, which show the effect of the wet winter of 1935/36. Rainfall was markedly heavier at Kirton and Southery in 1936 than in 1935, but at the other centres the difference was small. At Innerwick there was more sunshine in 1936 than in 1935, but the other four centres had considerably less, the difference being especially marked during the growing season.

In 1935 the plots developed normally and were lifted at each centre when both varieties were mature. In 1936, however, the normal development of the crop was seriously interrupted by blight at Kirton, Kirton Lindsey and Southery. The haulm of King Edward was killed off early, and the yield and size of tubers correspondingly reduced. Majestic was affected to a lesser extent.

The plots were generally lifted by hand, but in 1936 at Southery a spinner was used and in the same year at Kirton Lindsey the potatoes were ploughed out. The produce of each plot was dressed over a 1⅝ inch riddle and 56 lb. of ware was sent to Cambridge from each, and stored under cool conditions. Owing to the effect of blight, however, full samples of King Edward could seldom be obtained in 1936.

In each year the samples of both varieties from Innerwick were very much more attractive in appearance than those from the other centres.

The samples grown on black fen at Southery in 1935 were bold, even in shape and size, and very clean. The King Edwards were well coloured and no fault could be found with either variety apart from any possible objection to the dark colour of the adhering soil. The 1936 samples were less attractive, but appeared equal to those from Kirton and Ormskirk. The Kirton Lindsey samples were very satisfactory, apart from some cracking in Majestic in 1935 and the small size of King Edward in 1936. The Kirton and Ormskirk samples were rather small but were very even in shape and otherwise satisfactory.

For the actual cooking tests a 20 lb. sample was drawn from the 56 lb. sent to Cambridge from each plot. Every effort was made to ensure that the size of the tuber was the same throughout, but the disparity between the crops of the two varieties in 1936 made this impossible, for in many cases the King Edward plots did not yield as much as 20 lb. of ware in all.

On arrival at the laboratory, the potatoes were wiped free from adhering soil and notes were made on their general condition and on their average weight and specific gravity (Tables III and IV).

The potatoes were then steamed and fried, a maximum of ten marks each being given for colour, flavour and consistency. The actual marks awarded being the mean of those given by the members of a panel usually consisting of five testers. The times of cooking were noted in each case and will be found in Table V. It will be noted that both the steaming and frying times are roughly 40 per cent. longer in 1936 than in 1935. The differences within each year's samples are similar. Frying times are much the same throughout each year's samples. Steaming times are on the average shorter for King Edward than Majestic, and longer for the Innerwick and Ormskirk samples of each variety than for the other centres.

Steaming was carried out over similar flames, and the following standard for steamed potatoes was borne in mind. The flavour should be definite, but not stale or earthy; the colour both inside and out should be a uniform pale cream; in consistency, the potato should be soft and floury, retaining its shape when handled, but easily mashed; a glutinous or waxy texture was considered a serious fault.

For frying, the potatoes were cut into chips about 1 cm. thick and placed in wire baskets in a bath of hot oil, which was maintained at 200°C. during cooking. The following standard was kept in mind. The fried potatoes should have sufficient potato flavour to taste above the oil, but should not taste earthy; the colour should be an even, clear, golden-brown, for, if the chips have been fried at the correct temperature, patchiness would be due to faults in the potato, any darkness showing through the golden colour. The chips should break cleanly and the interior should be floury, without being over moist or showing holes.

The cooking tests were carried out during November in each year, the samples being stored together at Cambridge until required. Since six plots of each variety were grown at each of the five centres, the total number of samples in each year should have been sixty. In 1936 however, owing to a misunderstanding at one centre, only five plots were planted and the number of replications of which use was made was reduced to five throughout. The despatch of samples was spread over four weeks, sets of five samples being sent to the laboratories three times a week. The order in which the samples were dealt with was fixed in advance, one from each centre being selected to be sent on each date, the pairs of varieties being first randomized, and then the varieties within each pair.

In this way it was possible to make some estimate of the effect of the date of test on the results, and it was found that in 1935 the marks awarded on different dates varied very little. In 1936 there were considerable differences between the levels of marking; for example, the level of marks awarded on the fifth and sixth dates was significantly lower than on other days, while on the seventh and eighth dates the general level was high. The differences were, however, similar in all categories and there was no evidence that the comparisons between varieties or centres were affected.

The significant differences between centres are summarized in Table VI and the average marks awarded in each year in Tables VII and VIII.

The relative behaviour of the varieties at the different centres was similar and the individual markings are therefore omitted.

As far as the varieties were concerned in 1935 there was no significant difference between King Edward and Majestic in flavour or colour when steamed, or colour, consistency and total points when fried; in 1936 the differences in consistency when steamed, or in flavour or colour when fried, were not statistically significant, although decidedly in favour of King Edward. Every other difference in each year was in favour of King Edward, both steamed and fried.

The centre which produced the best all round cooking quality in each year was Innerwick; in 1935 the second place was taken by Kirton Lindsey and in 1936 by Kirton.

The differences in steaming quality were generally greater than those in frying, but on the whole the soils which produced the best potatoes for steaming also produced the best for frying. Exceptions occurred at Kirton in 1935 and Ormskirk in 1936. At Kirton the 1935 samples showed excellent frying characters but only moderate steaming quality; in 1936 steaming and frying qualities at this centre were both good.

At Ormskirk while the 1935 samples showed poor quality on all points, the 1936 samples proved to be good for frying but poor for steaming.

The results do not show any very definite agreement with those obtained in the 1931 experiments. The latter, however, consisted of single plots and were in any case confined to a single season. Apart from the fact that Kirton produced much better cooking quality in 1936 and Southery rather worse, the 1935 and 1936 results showed very fair agreement.

It is not possible to say how far weather may override soil conditions in affecting potato quality, but it is of note that the most consistent quality was found in the samples from the Dunbar red soil at Innerwick. This was in fact the centre which showed least variation in weather conditions.

The striking difference between cooking qualities of the black soil samples in 1935 and 1936 should also be noted, for the 1935 samples were generally equal to those from Innerwick. It would seem that in some seasons the practice of giving a lower market value to black soil samples may be unjustified.

From the number of variable factors involved it is clear that the evaluation of their effect on cooking quality will involve further prolonged and detailed research, and that it cannot adequately be undertaken by the Institute. In the circumstances the present series of trials will not be continued.

It remains to thank Mr. E. B. Hughes and the staff of Messrs. Lyons Research Laboratories who carried out the cooking tests; Mr. J. C. Wallace, and Messrs. H. Gates, R. E. Hardy and W. Macnaughton, who went to a great deal of time and trouble to grow the plots and to prepare the samples; and finally Dr. L. H. Lampitt, of Messrs. Lyons, whose criticism and advice were invaluable.

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I. DISTANCE BETWEEN ROWS AND SETTS IN INCHES, MANURING PER ACRE, AND PREVIOUS CROPPING.

Centre	Innerwick	Kirton Lindsey	Kirton	Ormskirk	Southery
Soil	Dunbar red sandstone	Oolitic limestone	Medium heavy silt	Light sandy loam	Black fen
1935	27 × 16 12 loads dung 3 cwt. sulphate ammonia 3 cwt. sulphate of potash 3 cwt. superphosphate Seeds hay	30 × 16 10 loads dung 2 cwt. sulphate of ammonia 2 cwt. sulphate of potash ½ cwt. steamed bone flour 4 cwt. superphosphate Crimson clover (folded)	27 × 16 No dung 16 cwt. compound artificial containing Ammonia 8·3% Potash 11·1% Soluble phosphate 13·3% Peas (harvested)	28 × 16 16-18 loads dung 1 cwt. sulphate of ammonia 2 cwt. sulphate of potash 1 cwt. superphosphate Mustard and fallow	28 × 16 10 loads dung 8 cwt. superphosphate Sugar beet
1936	27 × 16 12 loads dung 3 cwt. sulphate of ammonia 3 cwt. sulphate of potash 3 cwt. superphosphate ½ cwt. steamed bone flour Seeds hay	28 × 18 10 loads dung Artificials as in 1935 Seeds hay	27 × 16 10 loads dung 16 cwt. mixed artificials containing Ammonia 7·65% Potash 10·0% Soluble phosphate 12% Insoluble phosphate 6% Clover	28 × 16 16-18 loads dung 3 cwt. compound artificials containing Nitrogen (as sulphate of ammonia) 20·6% Potash 48·5% Soluble phosphate 15·1% Mustard and fallow	29 × 16 10 loads dung 5 cwt. superphosphate Sugar beet

IIA. RAINFALL IN INCHES.

	Innerwick	Kirton	Kirton Lindsey	Ormskirk	Southery
1934-35.					
Nov. - Jan. ...	6·03	7·31	7·04	8·72	5·00
Feb. - April ...	4·96	5·01	5·68	6·34	4·59
May - July ...	4·11	2·84	3·16	5·82	4·29
Aug - Oct. ...	8·41	8·60	9·54	14·48	7·86
Total ...	23·51	23·76	25·42	35·36	21·74
1935-36.					
Nov. - Jan. ...	6·58	10·43	8·89	10·52	7·12
Feb. - April ...	5·12	5·07	5·10	5·38	3·94
May - July ...	5·91	8·56	8·96	9·18	9·58
Aug - Oct. ...	5·91	4·95	4·77	7·24	6·74
Total ...	23·52	29·01	27·72	32·32	27·38

IIB. SUNSHINE IN HOURS.

	Innerwick	Kirton	Kirton Lindsey	Ormskirk	Southery
1934-35.					
Nov. - Jan. ...	122·1	128·0	129·3	111·4	116·3
Feb. - April ...	302·1	339·2	322·0	335·9	324·7
May - July ...	595·2	716·7	708·7	681·4	673·3
Aug. - Oct. ...	372·0	453·0	471·2	405·1	456·5
Total ...	1391·4	1636·9	1631·2	1533·8	1570·8
1935-36.					
Nov. - Jan. ...	184·1	148·3	159·8	136·2	137·0
Feb. - April ...	335·4	300·9	359·5	309·5	321·5
May - July ...	604·0	507·7	534·3	521·6	543·6
Aug. - Oct. ...	387·7	406·8	477·6	371·2	387·6
Total ...	1511·2	1363·7	1531·2	1338·5	1389·7

III. AVERAGE WEIGHT OF TUBERS (GRAMMES).

	1935		1936	
	King Edward	Majestic	King Edward	Majestic
Innerwick ...	155	168	174	200
Kirton	132	134	149	170
Kirton Lindsey ...	141	181	120	198
Ormskirk ...	125	145	165	204
Southery ...	130	152	117	190

IV. SPECIFIC GRAVITY.

	1935		1936	
	King Edward	Majestic	King Edward	Majestic
Innerwick ...	1·084	1·088	1·090	1·084
Kirton	1·096	1·095	1·090	1·086
Kirton Lindsey ...	1·089	1·083	1·078	1·079
Ormskirk ..	1·095	1·096	1·079	1·086
Southery ...	1·092	1·089	1·062	1·070

V. TIME OF COOKING (MINS.)

	1935		1936	
	King Edward	Majestic	King Edward	Majestic
Steaming.				
Innerwick ...	52	55	78	77
Kirton ...	46	52	73	69
Kirton Lindsey	48	45	63	77
Ormskirk ...	52	59	77	73
Southery ...	46	49	70	74
Frying.				
Innerwick ...	5	4	10	9
Kirton ...	7	5	12	11
Kirton Lindsey	7	6	11	9
Ormskirk ...	9	7	8	11
Southery ...	9	8	10	11

VI. CENTRES (TAKING BOTH VARIETIES TOGETHER).

Treatment	Character	1935.	1936.
Steamed	Total of all points	Innerwick, Kirton Lindsey and Southery better than Kirton or Ormskirk.	Innerwick better than Kirton Lindsey, Ormskirk or Southery; Kirton better than Ormskirk or Southery; Kirton Lindsey and Ormskirk better than Southery.
,,	Flavour	No significant difference.	Innerwick and Kirton better than Kirton Lindsey, Ormskirk or Southery.
,,	Colour (whole)	Innerwick better than Ormskirk, Southery or Kirton; Kirton Lindsey better than Ormskirk or Kirton; Ormskirk and Southery better than Kirton.	Innerwick better than Ormskirk or Southery; Kirton Lindsey better than Southery.
,,	Colour (mashed)	Innerwick and Kirton Lindsey better than Ormskirk, Southery or Kirton; Ormskirk and Southery better than Kirton.	Innerwick, Kirton and Kirton Lindsey better than Ormskirk or Southery.
,,	Consistency	Southery better than Innerwick, Kirton or Ormskirk; Kirton Lindsey better than Ormskirk.	Innerwick and Kirton better than Ormskirk or Southery.
Fried	Total of all points	No significant difference.	Innerwick better than Kirton Lindsey or Southery; remainder better than Southery.
,,	Flavour	Kirton Lindsey better than Innerwick or Kirton; Ormskirk and Southery better than Innerwick.	No significant difference.
,,	Colour	Innerwick better than Kirton, Ormskirk or Southery; Kirton Lindsey better than Ormskirk or Southery.	No significant difference.
,,	Consistency	No significant difference.	Innerwick better than Kirton Lindsey or Southery; Kirton and Ormskirk better than Southery.

VIIA. AVERAGE MARKS (CENTRES).

Steamed potatoes

Maximum = 100.

	Innerwick	Kirton	Kirton Lindsey	Ormskirk	Southery	Significant difference
1935.						
Flavour ...	74	74	78	74	77	—
Colour (whole)	35	23	34	29	31	4
Colour (mashed)	39	26	37	30	33	4
Consistency ...	80	79	84	77	85	5
Total ...	76	67	78	70	75	5
1936.						
Flavour ...	80	81	74	75	68	5
Colour (whole)	30	26	27	23	22	4
Colour (mashed)	32	32	30	26	23	4
Consistency ...	82	81	74	71	67	9
Total ...	74	73	68	65	59	6

VIIB. AVERAGE MARKS (CENTRES).
Fried potatoes.
Maximum = 100.

	Innerwick	Kirton	Kirton Lindsey	Ormskirk	Southery	Significant difference
1935.						
Flavour ..	72	76	81	78	79	5
Colour ...	82	73	77	69	70	7
Consistency ...	71	78	78	78	79	—
Total ..	75	76	78	75	76	—
1936.						
Flavour ..	82	81	79	81	74	—
Colour ...	77	74	74	75	69	—
Consistency ...	84	82	80	83	77	4
Total ...	81	79	77	79	73	3

VIII. AVERAGE MARKS (VARIETIES).
Maximum = 100.

Character	1935			1936		
	King Edward	Majestic	Significant difference	King Edward	Majestic	Significant difference
Steamed.						
Flavour ...	76	75	—	79	72	4
Colour (whole)	34	27	2	30	20	3
Colour (mashed)	35	31	2	33	24	3
Consistency ...	80	82	—	78	72	—
Total ...	75	72	2	73	63	4
Fried.						
Flavour ...	79	76	2	81	78	—
Colour ...	74	75	—	75	72	—
Consistency ...	77	76	—	83	80	2
Total ...	77	75	—	79	77	2

OFFICIAL SEED TESTING STATION FOR ENGLAND AND WALES.

EIGHTEENTH ANNUAL REPORT, 1934-35.

A. EASTHAM, D.S.O., M.C., B.Sc., and C. C. BRETT, M.A.

During the period covered by the following report, the Station dealt with more samples than in any season since its inception, the total number of samples received for analysis reaching 28,327. This figure is 1,250 more than in the preceding year and nearly 4,000 more than the average of the sixteen previous seasons. Each year a considerable number of tests are conducted in connection with certain investigations which go on from year to year, and others as a result of problems which arise during the course of the season. In the season under review such additional tests amounted to 2,175, thus bringing the total of samples tested to 30,502.

SOURCES OF SAMPLES RECEIVED.

The number of seed firms and farmers submitting samples for analysis during the season is shown in Table I, together with the actual number of samples from these sources. The number of samples received from farmers includes only those tested for farmers and growers at the special reduced fee, i.e. where the results of the tests were to be used for seeding and not for sale purposes. In those cases where the results on farmers' samples were for sale purposes, to enable the senders to comply with the provisions of the Seeds Act 1920, the full fees were charged and the number of such samples has been included in the figure representing the number of samples from seed firms. Samples from public departments include control samples and reserve portions, taken by inspectors of the Ministry of Agriculture in connection with the administration of the Seeds Act.

The number of seed firms sending samples shows a further decline, but the number of samples from this source is the highest yet recorded and brings the average number of samples per firm up to 15.08 — a very high level. In the case of the number of farmers sending samples and of the number of samples from this source, a somewhat considerable falling off is recorded, compared with the three previous seasons.

Table I. *Shows sources of samples received.*

		1934-35	1933-34	1932-33
Seed Firms.	Number sending samples ...	**1502**	1592	1650
„ „	„ of samples received ...	**22652**	20765	22055
Farmers, etc.	„ sending samples ...	**665**	922	1032
„ „	„ of samples received ...	**1821**	2291	2341
Public Depts.	„ of samples received ...	**3854**	4021	3443
Total number of samples		**28327**	27077	27839

DISTRIBUTION OF SAMPLES ACCORDING TO SPECIES.

The distribution, according to species, of the samples received is shown in Table II, together with comparable figures for the two previous years. Increases in numbers in the cereal, pulse and vegetable groups more than compensate for the decreases in the clover and grass groups, the increase in the total number of samples received being due to the increased numbers of cereals and pulses. In the cereal group the figure for wheat samples is the highest yet recorded, but the increase in numbers is largely offset by the fall in barley samples, where the figure recorded is one of the lowest for this seed. Oat samples show a definite increase, compared with the previous season, bringing the figure rather above the average of all previous seasons. The quality of oat samples was generally lower than in the immediately preceding season and the increase in numbers here recorded is no doubt chiefly due to this fact. In the pulse group, substantial relative increases are shown in the case of both peas and beans. Although the total figure for root and vegetable seed samples is only slightly more than in the previous season, yet the figure recorded is the highest since 1930-31. It is, perhaps, significant that a decrease in numbers is shown in the case of all the " field " brassica species, whereas increases occur in each of the " market garden " seeds. Within the clover group little marked change is shown except in the case of white clover and crimson clover. In the former, the figure recorded is the lowest since 1925-26 and in the latter more than twice the number of samples were received than in the immediately preceding season. Red clover samples again show an upward trend, there having been only two previous seasons when this year's total was exceeded. The total number of samples in the grass group is very similar to that of the previous season, thus maintaining the high level reached in that year. The substantial increases in numbers of perennial ryegrass, timothy, dogstail and mixtures are offset by the fewer samples of Italian ryegrass, cocksfoot, meadow fescue and " other grasses ". Although the number of samples described here as "other grasses" is somewhat less than in the previous season, yet it is still very high compared with earlier years. The large number of samples shown under the heading " miscellaneous " includes mostly flower seed samples and certain samples submitted for special examination for the presence of *Orobanche spp.* in compliance with particular export requirements.

Table II. *Shows number of samples of different kinds of seeds tested.*

	1934-35	1933-34	1932-33
Cereals			
Wheat	**4896**	4465	4575
Barley	**1265**	1611	1543
Oats	**4638**	3818	4771
Rye	**157**	126	131
Maize	**33**	36	47
	10989	10056	11067
Pulses			
Peas	**1711**	1514	2045
Beans	**454**	345	367
Vetches	**331**	382	407
	2496	2241	2819
Roots and Vegetables			
Turnip	**469**	526	472
Swede	**648**	687	613
Rape	**60**	81	88
Kale	**342**	390	297
Cabbage	**495**	509	402
Brussels Sprouts .	**110**	88	74
Broccoli and Cauliflower ...	**377**	314	297
Other Crucifers ...	**152**	126	133
Mangold	**934**	903	988
Beet	**715**	777	819
Onion	**483**	411	458
Parsnip	**139**	136	110
Carrot	**320**	262	259
Other Vegetables . .	**276**	249	369
	5520	5459	5379
Clovers			
Red Clover	**2887**	2831	2645
Alsike	**236**	281	324
White Clover .	**1103**	1317	1166
Trefoil	**367**	377	461
Lucerne	**127**	111	109
Sainfoin ...	**271**	280	249
Crimson Clover ...	**141**	65	79
Other Legumes ...	**41**	60	44
	5173	5322	5077
Grasses			
Perennial Ryegrass	**1027**	944	840
Italian Ryegrass	**506**	555	514
Cocksfoot	**332**	420	374
Timothy ..	**273**	211	209
Meadow Fescue	**101**	127	110
Crested Dogstail	**235**	218	200
Other Grasses . .	**1022**	1053	877
Mixtures	**370**	344	284
	3866	3872	3408
Linseed	**36**	13	15
Forest Trees	**93**	86	49
Miscellaneous	**154**	28	25
	283	127	89

SAMPLES RECEIVED EACH MONTH.

The distribution of samples per month during the season is shown in Table III, together with corresponding figures for 1933-34. The number of samples received in September and October exceeds the average of all previous seasons by over a thousand samples in each month. Apart from this striking difference, the monthly totals follow closely the trend of previous years, the actual figures in each month, however, being in excess of the averages except in April and May. The high levels reached in February and March resulted in the average number of samples received per working day reaching practically 200.

Table III. *Shows number of samples received per month.*

Season.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
1934-35 ..	**1419**	**2985**	**3977**	**2215**	**1963**	3292
1933-34 ..	1313	2765	3572	2377	2025	3310
Season.	Feb.	Mar.	April	May	June	July
1934-35 ..	**4370**	**4843**	**1991**	**502**	**400**	**370**
1933-34 ..	4262	4349	1791	618	286	409

PURITY AND GERMINATION.

In the Tables IV, V, VI and VII which follow, the average germination figures for the season—of the various species tested—are shown, and in Tables VI and VII average purity figures are also included. Figures representing the total averages of previous seasons are shown for comparative purposes. As a further indication of general quality, the percentage number of samples germinating below the minimum percentage of germination provided in the Seeds Regulations 1922 is given for those seeds for which such a standard has been prescribed. In the case of grasses and clovers, the tables also include figures showing the percentage number of samples containing one per cent. or more of " injurious weed seeds ".

Of the seed species which habitually lose vitality somewhat rapidly, more examples are met with amongst root and vegetable seeds than in any other class of seed and in most seasons the Station receives many samples of such seeds from " carried over " stocks. These are not infrequently of low germination and in the majority of cases the bulks they represent would not be distributed. Consequently the figures in Table V do not necessarily reflect accurately the quality of the majority of the bulks of root and vegetable seeds passing through the usual trade channels throughout the country.

Quite 75% of the different species listed in the following tables show average germination figures which are up to or even well in excess of the averages of all previous seasons and in a number of cases the figures shown are higher than any previously recorded. High average figures for germination are shown by all the cereals except oats; all the pulses except dwarf beans; all the root and vegetable seeds except turnip, swede and kale. In the case of parsnip it is noteworthy that the general quality as judged from average figures, has shown a marked improvement since the early years of the Station's activities and that during the past eight years the average germination has never been less than 70%. The grasses generally show

somewhat low purity averages compared with previous years, but high germination averages. Timothy, meadow fescue, hard fescue, tall oat grass and chewing's fescue, however, are exceptions, the first four species showing both low purity and germination averages. Clovers on the whole are above average quality, particularly in the case of trefoil and sainfoin. As in the previous season, a relatively high percentage of " hard seeds " is shown in most of the clover species.

Table IV. *Shows percentage germination of cereals.*

	Number of samples included in the averages	Average percentage of germination		Percentage of samples below authorised minimum.	
		1934-35	1917-34	**1934-35**	1933-34
Wheat	4641	**97·9**	95·7	**1·8**	1·8
Barley	1194	**96·5**	95·1	**6·5**	8·3
Oats	4403	**93·2**	93·4	**6·7**	3·1
Rye	144	**93·3**	90·3	**6·9**	11·8

Table V. *Shows percentage germination of pulses and root and vegetable seeds.*

	Number of samples included in the averages	Average percentage of germination		Percentage of samples germinating below authorised minimum (authorised minimum in brackets)
		1934-35	1917-34	
Peas (Field and Garden)	1488	**93·8**	87·9	3·7 (80 F., 70 G.)
Beans (Field) .. .	157	**96·8**	95·4	2·5 (90)
Beans (Broad) . ..	64	**97·6**	93·8	0·0 (75)
Beans (Runner) ...	112	**90·8**	80·3	1·8 (60)
Beans (Dwarf) . .	74	**83·4**	84·2	3·0 (75)
Vetches	302	**95·6**	89·2	7·0 (90)
Turnip (Field and Garden) ..	369	**80·3**	86·1	33·1 (80 F., 75 G.)
Swede	563	**83·9**	85·3	20·1 (80)
Rape	58	**95·3**	87·9	5·2 (80)
Kale	321	**78·6**	80·4	19·3 (70)
Cabbage	397	**80·8**	79·7	13·8 (70)
Brussels Sprouts	79	**88·0**	80·2	8·8 (70)
Broccoli and Cauliflower	325	**78·1**	75·7	10·2 (60)
Kohl Rabi	44	**80·7**	73·4	7·1 (70)
Mangold	783	**81·4**	75·8	5·2 (60)
Beet (Garden) . .	200	**76·9**	71·8	3·5 (50)
Beet (Sugar)	385	**82·1**	80·4	2·0 (60)
Parsnip	52	**77·2**	64·7	4·0 (45)
Carrot	178	**69·1**	64·8	6·2 (50)
Onion	351	**73·4**	69·8	17·9 (60)
Other seeds.		**1934-35**	1933-34	
Mustard	44	**86·4**	89·5	
Lettuce	76	**83·1**	86·5	
Radish	52	**88·1**	87·0	
Celery	83	**74·6**	67·9	
Parsley	26	**63·9**	63·7	
Spinach	18	**85·5**	82·6	
Flax	33	**95·1**	93·7	

Table VI. *Shows percentage purity and germination of grasses.*

	No. of samples included in the averages	Average percentage of impurities		Percentage of samples with 1% or over of injurious weed seeds		Average percentage of germination	
		1934-35	1922-34	**1934-35**	1933-34	**1934-35**	1922-34
Perennial Ryegrass ...	737	**3·86**	2·86	**20·2**	14·7	**89·2**	82·4
Italian Ryegrass ...	413	**3·37**	2·76	**21·1**	19·3	**87·1**	82·6
Cocksfoot	221	**9·58**	9·81	**0·5**	0·0	**86·0**	85·9
Timothy	192	**2·40**	1·74	**4·1**	2·7	**88·1**	89·5
Meadow Fescue . .	71	**3·05**	2·37	**4·2**	3·5	**77·3**	84·6
Dogstail	207	**3·59**	3·22	**2·9**	5·5	**85·2**	80·8

Other grasses not scheduled in the Seeds Regulations.

		1934-35	1933-34			**1934-35**	1933-34
Hard Fescue	90	**10·1**	7·8			**74·3**	82·3
Tall Oat Grass	9	**14·1**	7·6			**71·0**	91·2
Agrostis spp.	174	**6·4**	6·0			**87·4**	89·4
Meadow Foxtail ...	15	**35·2**	34·3			**62·0**	67·6
Poa trivialis	73	**8·7**	8·3			**84·6**	87·1
Poa pratensis	62	**16·3**	13·5			**81·3**	82·0
Poa nemoralis	26	**18·2**	18·8			**83·0**	74·2
Chewing's Fescue . .	155	**1·5**	1·1			**74·4**	87·3
Sheep's Fescue	46	**18·3**	13·1			**64·5**	70·9
Tall Fescue	9	**4·8**	4·8			**86·4**	80·7
Red Fescue	80	**7·3**	6·6			**81·3**	84·2

Table VII. *Shows percentage purity and germination of clovers.*

	No. of samples included in the averages	Average percentage of impurities		Percentage of samples with 1% or over of injurious weed seeds		Average percentage of germination		Average percentage of hard seeds	
		1934-35	1917-34	**1934-35**	1933-34	**1934-35**	1917-34	**1934-35**	1917-34
Red Clover (All Samples)	2435	**3·61**	3·56	**1·5**	3·5	**80·2**	78·5	**7·0**	4·6
„ „ (English) .	945	**3·36**	3·20	**1·7**	1·9	**85·7**	79·1	**7·9**	5·1
„ „ (Chilean)	71	**0·83**	1·92	**0·0**	0·0	**85·7**	89·2	**8·0**	6·2
„ „ (American) .	27	**1·23**	1·58	**0·0**	0·0	**91·5**	90·4	**5·7**	5·4
Alsike (All Samples)	140	**3·94**	4·42	**0·0**	0·8	**84·3**	80·3	**5·9**	6·3
White Clover (All Samples) .	920	**5·45**	7·10	**5·7**	6·2	**80·8**	77·3	**12·8**	10·5
„ „ (English) .	50	**4·83**	5·30	**24·0**	19·4	**84·3**	81·8	**6·9**	7·2
„ „ (Mid-European)	145	**3·90**	4·80	**5·5**	6·5	**84·1**	85·5	**7·6**	6·4
„ „ (New Zealand) ..	14	**2·30**	3·58	**0·0**	0·0	**87·7**	87·9	**5·3**	7·4
Wild White Clover	589	**5·86**	8·18	**4·4**	3·8	**77·9**	74·5	**12·7**	13·1
Trefoil	250	**1·56**	1·47	**0·0**	0·3	**85·1**	76·0	**2·9**	2·6
Lucerne	95	**2·45**	2·44	**0·0**	0·0	**76·0**	81·4	**7·0**	5·5
Sainfoin	242	**1·54**	3·23	**0·0**	0·0	**84·0**	71·4	**1·6**	0·4
Crimson Clover	59	**4·33**	3·14	**0·0**	4·2	**78·0**	81·2	**1·8**	0·4

DODDER IN CLOVER SAMPLES.

In the following table, the percentage of samples found to contain seeds of clover dodder, in the season under review, is given for each of the species where such examination is made, together with corresponding data for each preceding year. English red clover samples found to contain dodder show a somewhat marked increase compared with the previous three years.

Table VIII. *Shows percentage of samples containing dodder.*

	RED CLOVER.					
	All Samples	English	French	Chilean	U.S.A.	New Zealand
1934-35	**5·7**	**2·2**	—	**90·2**	**0·0**	—
1933-34	6·2	1·6	0·0	95·7	8·0	0·0
1932-33	5·5	0·5	3·8	89·2	14·2	0·0
1931-32	3·6	0·8	0·1	92·0	8·3	0·0
1930-31	2·8	1·7	12·9	91·6	0·0	0·0
1929-30	4·0	1·5	0·0	80·0	33·3	0·0
1928-29	4·9	2·2	14·2	85·0	0·0	14·3
1927-28	8·5	3·4	13·9	86·6	0·0	0·0
1926-27	6·5	3·6	7·3	89·6	0·0	0·0
1925-26	7·2	3·2	9·7	89·1	0·0	25·0
1924-25	10·1	5·3	8·3	94·5	11·1	20·0
1923-24	10·5	5·9	8·0	98·5	0·6	1·4
1922-23	29·4	17·6	8·8	91·7	18·0	23·5
1921-22	21·8	10·2	18·2	83·6	0·0	0·0
1920-21	19·2	4·4	13·4	82·6	30·0	10·0
1919-20	18·9	3·4	15·4	81·1	10·1	0·0
1918-19	27·3	12·1	36·6	90·9	10·1	—

	ALSIKE	WHITE CLOVER			ALSIKE AND WHITE	LUCERNE
		All Samples	Mid-European	New Zealand		
1934-35	**0·0**	**0·4**	**0·0**	**0·0**	**1·0**	**8·4**
1933-34	0·0	0·0	0·0	0·0	1·0	5·1
1932-33	0·0	0·0	0·0	0·0	1·3	6·7
1931-32	0·0	0·1	0·0	0·0	2·4	9·4
1930-31	0·5	1·3	5·1	0·0	5·9	8·6
1929-30	0·6	0·6	4·4	0·0	9·7	8·7
1928-29	1·6	0·1	6·1	0·0	0·7	9·4
1927-28	0·0	0·1	5·6	0·0	0·0	5·9
1926-27	0·0	0·4	2·1	7·1	5·8	5·7
1925-26	0·0	1·5	0·0	12·5	0·0	11·3
1924-25	1·3	5·6	12·9	37·5	2·9	12·5
1923-24	1·0	2·4	0·0	66·6	2·0	11·1
1922-23	4·1	17·6	5·0	48·3	22·2	11·5
1921-22	6·4	4·5	3·5	25·0	7·9	7·3
1920-21	5·5	3·4	12·5	9·4	16·1	12·3
1919-20	6·1	3·1	11·1	0·0	13·6	12·2
1918-19	less than 1·0	1·3	—	—	less than 1·0	6·7

A dash sign, thus —, in this table indicates that no samples were received.

VARIETIES OF CEREALS.

In Table IX is shown the distribution of cereal samples according to variety. These figures are not necessarily representative of the areas sown, but they give an indication of the relative popularity of different varieties. Samples are sometimes received at the Station bearing no varietal name, so that two sets of figures are shown for each variety quoted in the table — one set gives the percentage occurrence amongst all samples and the other the percentage amongst named varieties only. Only those varieties are included which are present to an extent of at least 0·9% of all samples. There is no significant change in the order of the first few varieties in any group, when compared with the past three or four years.

Table IX. *Shows distribution of cereal samples according to variety.*

	Percentage of total	Percentage of named varieties		Percentage of total	Percentage of named varieties
		WHEAT.			
Little Joss ...	12·5	14·7	Squarehead	1·8	2·1
White Victor .	12 2	14·4	Chevalier .	1·5	1·7
Red Standard .	11·0	12·9	Million III	1·5	1·7
Squarehead's Master	8·0	9·5	Rivett	1·3	1·5
Wilhelmina	6·7	8·0	April Bearded	1·1	1.3
Yeoman ..	5·2	6·1	Miller . ..	1·1	1.3
Red Marvel ...	3·9	4·6	A.1.	0·9	1·1
Garton's "60" .	2·9	3·4	Crown	0·9	1·1
Squarehead II .	2·4	2·8	Other named varieties	8·0	9·5
Renown .. .	1·9	2·3	Not named	15·2	
		BARLEY.			
Spratt Archer ..	17·6	31·9	Pembroke	1·6	3·0
Plumage Archer	15·6	28·4	Plumage .	1.5	2·7
New Cross .. .	5·1	9·3	Chevallier .	1·4	2·5
Beaven's Plumage .	2·9	5·3	Standwell .	1·1	2·0
Golden Archer	2·6	4·6	Other named varieties	3·9	7·0
Beaven's Archer .	1·8	3·3	Not named	44·9	
		OATS.			
Victory	17·4	20·2	Golden Rain	2·3	2·7
Abundance	8·0	9·2	Black	1·9	2·2
Black Winter ..	6·0	6·9	Prolific	1·8	2·0
White Winter .	5·8	6·7	Star ...	1·6	1·9
Marvellous	5·8	6·7	Superb .	1·5	1·8
Grey Winter ..	5·5	6·3	Unique	1·4	1·7
White . .	5·3	6·1	Black Sprig	1·2	1·4
Black Supreme ...	5·1	5·9	Progress	1·0	1·2
Black Tartar .	4·0	4·6	Other named varieties	8·1	9·4
Yielder	2·7	3·1	Not named . .	13·6	

SEED-BORNE DISEASES.

A. Diseases of Cereals.

Naked-eye examination for the presence of certain seed-borne diseases has been made of all cereal samples concerned. Figures showing the percentage of samples with "naked-eye" evidence of infection are given in Table X, together with comparable figures for the previous season. The cereal samples so examined would have been derived almost entirely from the harvest of 1934. Smutted grain in barley continues the upward trend evidenced in the previous season, but ergot in wheat and in rye both show figures lower than for some years. In the case of ergot in wheat, barley and rye, the actual amount of ergot present per infected sample was very little and in the majority of cases was, by weight, only a "trace".

Table X. *Shows percentage of cereal samples with "naked-eye" evidence of disease infection.*

	1934-35 per cent.	1933-34 per cent.
Bunt in Wheat	**4·1**	3·9
Earcockles in Wheat	**2·3**	2·5
Ergot in Wheat ..	**0·3**	1·2
Smut in Barley	**5·3**	3·7
Ergot in Barley ...	**0·0**	1·0
Ergot in Rye ...	**9·6**	10·9

B. Diseases of Celery.

49 samples of celery seed were submitted during the season, for examination for the presence of *Septoria Apii* Chester. (Celery leaf spot) and these samples were also examined for *Phoma apiicola* Kleb. (Phoma root rot). The table below shows the number and percentage of samples falling within certain ranges of infection.

Table XI. *Shows number and percentage of celery seed samples infected with Septoria Apii and Phoma apiicola.*

Celery Leaf Spot.

Range of infection per cent.	No. of samples	No. of samples as percentage
Nil	5	10·2
1—5	12	24·5
6—10	8	16·3
11—20	11	22·5
21—30	2	4·1
31—40	3	6·1
41—50	2	4·1
51—60	3	6·1
61—70	3	6·1

Phoma Root Rot.

Nil	27	55·1
1—5	11	22·5
6—10	3	6·1
11—20	6	12·2
21—30	2	4·1

MOISTURE CONTENT OF SEED SAMPLES.

170 samples were received for moisture content determination during the season, this number being made up as follows :—

Wheat	84 samples.
Oats	2 ,,
Peas	2 ,,
Sugar Beet	25 ,,
Chewing's Fescue ...	57 ,,

WILD WHITE CLOVER CERTIFICATION SCHEME

During the season 1934-35, the fifth year of the Scheme's operation, the number of samples of seed-heads collected from inspected pastures and received at the Station for the purpose of the " growing on " test reached only 37. The seed from these samples was rubbed out, scarified and sown in September 1934. The resulting plots were examined and reported upon in the early summer of 1935, by the committee set up for the purpose. The total number of plots sown from " head samples " collected during the first five years of the Scheme, has reached a total of 875. In addition, during this period 84 " type samples " from fields finally certified under the Scheme, were received at the Station and plots sown down from them, bringing the total of plots sown in connection with the Scheme to 959.

REFEREE SAMPLES.

A further series of referee samples was sent out during the season and tested at the Stations of all seed firms licensed to test the seeds in question. The results were tabulated and copies of the completed figures, together with explanatory notes, were subsequently sent to the firms concerned, by the Ministry of Agriculture, in Seed Analysts' Bulletin No. 26. An opportunity of discussing the results was afforded at the Tenth Conference of Seed Analysts which was held at the N.I.A.B. on the 18th July 1935.

COURSE AND EXAMINATION IN SEED ANALYSIS.

A course of instruction in the principles and practice of seed analysis was conducted at the Station in the summer of 1935, followed by an examination held on 16th and 17th July. Twenty candidates attended, including four members of the Station's own staff, and twelve satisfied the examiners in both theory and practice, thus qualifying for the certificate of proficiency awarded by the Station. Seven others passed in the practical work only and one candidate failed altogether.

INVESTIGATIONS.

Investigational work in progress during the season under review included further work upon the loss of vitality of seeds during storage; the effect upon the keeping quality of cereals after treating with certain organic mercury compounds; laboratory, greenhouse and field tests of peas in connection with an investigation into the effect of treating peas with certain organic mercury compounds; a large number of minor problems which arose during the season and required immediate attention.

OFFICIAL SEED TESTING STATION FOR ENGLAND AND WALES.

NINETEENTH ANNUAL REPORT.

Covering the period 1st AUGUST, 1935 — 31st JULY, 1936.

A. EASTHAM, D.S.O., M.C., B.Sc., and C. C. BRETT, M.A.

The number of samples received for analysis by the Station during the period covered by the following report constitutes a further record, the total of samples reaching 29,870. This figure is 1,543 more than the previous record of 1934-35, an increase of 5·4%. Furthermore, this season's figure is 5,295 more than the average of the preceding seventeen seasons. As in previous years a considerable number of tests of an investigational character have been made, the total of such tests reaching 2,035 in the present season, bringing the total of samples tested during the twelve months ending 31st July 1936 to 31,905.

SOURCES OF SAMPLES RECEIVED.

The number of seed firms and farmers submitting samples for analysis during the season is shown in Table I, together with the number of samples from these sources. The number of samples received from farmers includes only those tested for farmers and growers at the special reduced fee, i.e. where the results of the tests were to be used for seeding and not for sale purposes. In those cases where the results on farmers' samples were for sale purposes, to enable the senders to comply with the provisions of the Seeds Act, 1920, the full fees were charged and the number of such samples has been included in the figure representing the number of samples from seed firms. Samples from public departments include control samples and reserve portions taken by inspectors of the Ministry of Agriculture in connection with the administration of the Seeds Act.

The number of seed firms sending samples shows a slight increase, and the number of samples from this source an increase of 3·3% over the previous season. The number of samples from seed firms is the highest yet recorded and the average number of samples per firm amounts to 15·4. In the case of the number of farmers sending samples and of the number of samples from farmers, considerable increases are shown, amounting to

approximately 32% of the previous season's figures in each case. The number of samples from farmers has only once been exceeded—in 1931-32. Samples recorded as received from public departments show a considerable increase compared with the past few seasons, the figure shown having only twice been exceeded.

Table I. *Shows sources of samples received.*

		1935-36	1934-35	1933-34
Seed Firms.	Number sending Samples ..	**1519**	1502	1592
,, ,,	,, of samples received ...	**23397**	22652	20765
Farmers, etc.	,, sending samples ...	**877**	665	922
	,, of samples received ..	**2410**	1821	2291
Public Depts.	,, of samples received ...	**4063**	3854	4021
Total number of samples	.. ..	**29870**	28327	27077

DISTRIBUTION OF SAMPLES ACCORDING TO SPECIES.

The number of samples of each species received during the season, is shown in Table II, together with the total of samples in each group and comparable figures for the two preceding seasons.

The total increase in numbers over 1934-35 is chiefly accounted for in the cereal and pulse groups. The number of wheat samples received is the highest yet recorded and exceeds the previous season's figure, itself a record, by 1,095. Barley samples also show a fairly substantial increase, the figure recorded being the highest since 1931-32; this increase is largely offset, however, by the fall in oat samples. The total number of samples shown for the pulse group has only been exceeded on two previous occasions, and the figures for both peas and beans are amongst the highest recorded. There is no appreciable change in the total of root and vegetable seed samples, though the figure recorded is the highest for four years. Within the group however, somewhat significant increases in numbers are shown by kale, cabbage, beet and carrot and decreases by swede, mangold and "other vegetables." The total of clover samples has only once been exceeded—in 1921-22, increases of some importance within the group being shown in the case of red clover, white clover, trefoil and crimson clover and decreases by alsike and sainfoin. Only in the grass group is there a decrease in total numbers, but the total for the present season is still relatively high, having only been exceeded by the two immediately preceding years. A somewhat appreciable falling off in numbers is shown by all the species listed in the group, except "other grasses" and mixtures; the figure for Italian ryegrass is the lowest, yet recorded. The number of samples described as "other grasses" has reached a figure only two short of the previous record of 1933-34, thus maintaining the very satisfactory situation referred to in the report for that year. The further increase in the number of samples shown under the heading "miscellaneous" is accounted for chiefly by larger numbers of flower seed samples and of certain samples submitted for special examination for the presence of *Orobanche spp.* in compliance with particular export requirements.

Table II. *Shows number of samples of different kinds of seeds tested.*

	1935-36	1934-35	1933-34
Cereals			
Wheat	**5991**	4896	4465
Barley	**1705**	1265	1611
Oats	**4270**	4638	3818
Rye	**176**	157	126
Maize	**47**	33	36
	12189	10989	10056
Pulses			
Peas	**1895**	1711	1514
Beans	**503**	454	345
Vetches	**343**	331	382
	2741	2496	2241
Roots and Vegetables			
Turnip	**475**	469	526
Swede	**598**	648	687
Rape	**74**	60	81
Kale	**405**	342	390
Cabbage	**556**	495	509
Brussels Sprouts	**127**	110	88
Broccoli and Cauliflower	**374**	377	314
Other Crucifers	**146**	152	126
Mangold	**804**	934	903
Beet	**789**	715	777
Onion	**495**	483	411
Parsnip	**132**	139	136
Carrot	**351**	320	262
Other Vegetables	**219**	276	249
	5545	5520	5459
Clovers			
Red Clover	**2930**	2887	2831
Alsike	**213**	236	281
White Clover	**1172**	1103	1317
Trefoil	**474**	367	377
Lucerne	**114**	127	111
Sainfoin	**240**	271	280
Crimson Clover	**173**	141	65
Other Legumes	**44**	41	60
	5360	5173	5322
Grasses			
Perennial Ryegrass	**1002**	1027	944
Italian Ryegrass	**443**	506	555
Cocksfoot	**286**	332	420
Timothy	**198**	273	211
Meadow Fescue	**81**	101	127
Crested Dogstail	**214**	235	218
Other Grasses	**1051**	1022	1053
Mixtures	**386**	370	344
	3661	3866	3872
Linseed	**63**	36	13
Forest Trees	**104**	93	86
Miscellaneous	**207**	154	28
	374	283	127

SAMPLES RECEIVED EACH MONTH.

The distribution of samples per month during the season is shown in Table III together with corresponding figures for 1934-35. The number of samples received in September and October exceeds the average of all previous seasons by over 1,200 in each case, and the number of samples for March is in excess of the average of previous seasons by over 900. Apart from these differences, the monthly totals follow closely the trend of previous years, the actual figures for each month, however, being in excess of the averages except in January. For September and October the average number of samples received per working day is 140 and for February and March 200, whilst the average per working day over the whole year is only a few short of 100 samples.

Table III. *Shows number of samples received per month.*

Season.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
1935-36 ...	**1067**	**3168**	**4264**	**2224**	**1812**	**2998**
1934-35 ...	1419	2985	3977	2215	1963	3292
Season.	Feb.	Mar.	April	May	June	July
1935-36 ..	**4615**	**5534**	**2401**	**928**	**425**	**434**
1934-35 ...	4370	4843	1991	502	400	370

PURITY AND GERMINATION.

The average quality of the various species tested during the season is indicated in Tables IV, V, VI and VII. In each of these tables figures representing the average germination of each species are given, and in Tables VI and VII average purity figures are also included. For purposes of comparison, figures representing the total averages of all previous seasons are recorded. As a further indication of general quality, the percentage number of samples germinating below the minimum percentage of germination provided in the Seeds Regulations 1922, is given for those seeds for which such a standard has been prescribed. In the case of grasses and clovers, the tables also include figures showing the percentage of samples found to contain one per cent. or more of " injurious weed seeds ".

It should again be noted that of the seed species which invariably lose vitality somewhat rapidly, more examples are met with amongst root and vegetable seeds than in any other class of seed and that in most seasons the Station receives many samples of such seeds from " carried over " stocks. These are not infrequently of low germination and in the majority of cases the bulks they represent would not be distributed. Consequently the figures in Table V do not necessarily reflect with accuracy the quality of the majority of bulks of root and vegetable seeds passing through the usual trade channels throughout the country.

Approximately 80% of the species scheduled in the Seeds Regulations 1922 and listed in the following tables, show average germination figures for the season which are equal to, or well in excess of the averages of all previous seasons. In general it may be said that the average quality of the various species tested is even higher than in 1934-35.

The average germination figures for all the cereals, except rye, are somewhat above the averages of previous seasons and in each case are almost the highest so far recorded. Peas, beans and vetches are generally well above average. Turnip and swede are a little better than in the previous season, and all the other scheduled root and vegetable seeds are mostly well above and none fall below the averages of previous seasons. Somewhat exceptionally high average germination figures are shown for broad and dwarf beans, vetches, rape, kohl rabi, mangold, sugar beet, parsnip, carrot and flax.

All the scheduled grasses, with the exception of crested dogstail, are slightly above average with respect to purity and in nearly every case the figures recorded are higher than for two or three years. Improved quality is also reflected in the average germination of these species, timothy being the only one not above the average of all previous seasons. The average germination figures for Italian ryegrass and dogstail are the highest yet recorded and in the case of both perennial ryegrass and cocksfoot the figures are higher than for some three or four years. Amongst the grasses not scheduled in the Seeds Regulations 1922, hard fescue, tall oat grass, Agrostis spp., Poa nemoralis and sheep's fescue all show average germination figures amongst the highest yet recorded. The average purity of Agrostis spp., and of red fescue is lower than for some years.

On the whole, the clover species do not show quite such high average figures as in the immediately preceding season, though in some instances the figures for average purity and germination are still up to or somewhat in excess of the averages of all previous seasons. The figures for both purity and germination of English white clover have only been exceeded on two previous occasions and in the case of Mid-European and New Zealand white clover, the purity in each case, is amongst the highest recorded, whilst the germination figures are rather low compared with most earlier years. Trefoil, both with respect to purity and germination, shows higher average figures than in the majority of preceding seasons. The average germination figure for lucerne has only once been lower; sainfoin is not quite up to the quality of the previous two seasons and crimson clover is rather below average.

The average percentage of hard seeds in English red clover is still above that of all previous seasons, but rather lower than in the two immediately preceding seasons. In the case of white clover, wild white clover, lucerne and crimson clover, the figures for average percentage of hard seeds are amongst the highest so far recorded for each of these species.

Table IV. *Shows percentage germination of cereals.*

	Number of samples included in the averages	Average percentage of germination		Percentage of samples below authorised minimum.	
		1935-36	1917-35	**1935-36**	1934-35
Wheat	5693	**97·8**	96·0	**1·9**	1·8
Barley	1650	**96·4**	94·9	**6·8**	6·5
Oats	4087	**94·2**	93·4	**4·3**	6·7
Rye	136	**88·7**	90·4	**11·0**	6·9

Table V. *Shows percentage germination of pulses and root and vegetable seeds.*

	Number of samples included in the averages	Average percentage of germination		Percentage of samples germinating below authorised minimum (authorised minimum in brackets)
		1935-36	1917-35	
Peas (Field and Garden) ...	1661	**93·1**	88·3	3·4 (80 F., 70 G.)
Beans (Field)	213	**96·8**	95·3	4·2 (90)
Beans (Broad)	80	**98·2**	93·6	0·0 (75)
Beans (Runner)	79	**88·6**	80·9	6·3 (60)
Beans (Dwarf)	54	**91·2**	84·9	7·4 (75)
Vetches	311	**96·0**	89·5	7·7 (90)
Turnip (Field and Garden) .	373	**82·4**	86·8	31·1 (80 F., 75 G.)
Swede	496	**84·9**	84·0	22·1 (80)
Rape	63	**93·7**	88·3	1·6 (80)
Kale	368	**81·7**	80·2	13·3 (70)
Cabbage	442	**79·8**	79·7	19·0 (70)
Brussels Sprouts ...	87	**85·0**	80·6	13·8 (70)
Broccoli and Cauliflower	311	**76·5**	75·9	16·0 (60)
Kohl Rabi	22	**85·0**	74·8	9·1 (70)
Mangold	664	**82·6**	76·2	6·3 (60)
Beet (Garden) . .	216	**76 5**	72·4	4·2 (50)
Beet (Sugar) . .	430	**87·3**	80·3	0·2 (60)
Parsnip	32	**82·5**	65·1	6·3 (45)
Carrot . .	197	**71·1**	64·9	0·6 (50)
Onion	324	**72·8**	69·6	25·6 (60)
Other seeds.		**1935-36**	1934-35	
Mustard . .	54	**84·0**	86·4	
Lettuce	74	**82·5**	83·1	
Radish . . .	44	**88·2**	88·1	
Celery	59	**70·5**	74·6	
Parsley	25	**74·4**	63·9	
Spinach	17	**78·0**	85·5	
Flax	63	**95·5**	95·1	

Table VI. *Shows percentage purity and germination of grasses.*

	No. of samples included in the averages	Average percentage of impurities		Percentage of samples containing 1% or over of injurious weed seeds		Average percentage of germination	
		1935-36	1922-35	**1935-36**	1934-35	**1935-36**	1922-35
Perennial Ryegrass .	677	**2·60**	2·94	**12·3**	20·2	**88·6**	82·9
Italian Ryegrass ..	356	**2·26**	2·79	**16·3**	21·1	**90·1**	82·9
Cocksfoot	216	**9·48**	9·81	**0·5**	0·5	**88·4**	85·9
Timothy	145	**1·41**	1·81	**0·7**	4·1	**88·7**	89·3
Meadow Fescue .	61	**1·90**	2·42	**0·0**	4·2	**84·5**	84·1
Crested Dogstail . .	194	**3·53**	3·26	**2·1**	2·9	**89·9**	81·2

Other Grasses not scheduled in the Seed Regulations, 1922.

		1935-36	1934-35		**1935-36**	1934-35
Hard Fescue	102	**9·3**	10·1		**88·7**	74·3
Tall Oat Grass	9	**10·6**	14·1		**77·0**	71·0
Agrostis spp.	35	**10·6**	6·4		**90·9**	87·4
Brown Top	79	**3·9**	—		**93·1**	—
Red Top	31	**8·2**	—		**91·7**	—
Meadow Foxtail ...	15	**33·2**	35·2		**66·0**	62·0
Poa trivialis	84	**9·3**	8·7		**85·7**	84·6
Poa pratensis	116	**12·3**	16·3		**81·0**	81·3
Poa nemoralis	13	**17·3**	18·2		**86·0**	83·0
Chewing's Fescue ...	116	**1·7**	1·5		**81·8**	74·4
Sheep's Fescue	30	**15·7**	18·3		**79·2**	64·5
Tall Fescue	16	**4·4**	4·8		**82·4**	86·4
Red Fescue	53	**11·4**	7·3		**84·8**	81·3

Table VII. *Shows percentage purity and germination of clovers.*

	No. of samples included in the averages	Average percentage of impurities		Percentage of samples with 1% or over of injurious weed seeds		Average percentage of germination		Average percentage of hard seeds	
		1935-36	1917-35	**1935-36**	1934-35	**1935-36**	1917-35	**1935-36**	1917-35
Red Clover (All samples) .	2458	**3·87**	3·06	**1·9**	1·5	**81·2**	78·6	**6·1**	4·8
" " (English) .	980	**3·24**	3·22	**1·9**	1·7	**81·6**	79·5	**6·3**	5·3
" " (Chilean) .	90	**0·69**	1·82	**0·0**	0·0	**85·7**	88·9	**7·5**	6·0
Alsike (All samples)	146	**4·86**	4·35	**0·0**	0·0	**84·7**	83·0	**4·9**	6·3
White Clover (All samples) ...	965	**5·17**	6·97	**5·5**	5·7	**79·2**	77·6	**14·1**	10·7
" " (English) .	51	**3·33**	5·30	**33·3**	24·0	**85·4**	81·9	**7·5**	7·2
" " (Mid-European)	102	**3·17**	4·60	**1·9**	5·5	**82·9**	85·2	**7·0**	6·6
" " (New Zealand) ..	10	**1·43**	3·53	**0·0**	0·0	**83·4**	87·9	**6·8**	7·3
Wild White Clover ...	644	**6·76**	8·02	**2·5**	4·4	**76·6**	74·8	**17·3**	13·0
Trefoil	351	**0·72**	1·47	**0·0**	0·0	**84·4**	76·4	**2·1**	2·6
Lucerne	93	**2·17**	2·30	**0·0**	0·0	**72·6**	81·1	**8·0**	5·6
Sainfoin	212	**2·33**	3·13	**0·0**	0·0	**81·9**	72·3	**1·3**	0·4
Crimson Clover . .	72	**3·60**	3·19	**0·0**	0·0	**77·0**	81·2	**2·0**	0·4

DODDER IN CLOVER SAMPLES.

In the following table, the percentage of samples found to contain seeds of clover dodder, in the season under review, is given for each of the species examined, together with corresponding data for each of the previous seasons. In the case of Chilean red clover and of lucerne, the percentage of samples containing dodder is in the former lower than for some few years, and in the latter lower than in any preceding season.

Table VIII. *Shows percentage of samples containing dodder.*

	RED CLOVER.					
	All samples	English	French	Chilean	U.S.A.	New Zealand
1935-36	**6·1**	**0·9**	—	**81·1**	**6·2**	—
1934-35	5·7	2·2	—	90·2	0·0	—
1933-34	6·2	1·6	0·0	95·7	8·0	0·0
1932-33	5·5	0·5	3·8	89·2	14·2	0·0
1931-32	3·6	0·8	0·1	92·0	8·3	0·0
1930-31	2·8	1·7	12·9	91·6	0·0	0·0
1929-30	4·0	1·5	0·0	80·0	33·3	0·0
1928-29 ..	4·9	2·2	14·2	85·0	0·0	14·3
1927-28	8·5	3·4	13·9	86·6	0·0	0·0
1926-27 ...	6·5	3·0	7·3	89·6	0·0	0·0
1925-26	7·2	3·2	9·7	89·1	0·0	25·0
1924-25	10·1	5·3	8·3	94·5	11·1	20·0
1923-24 . ..	10·5	5·9	8·0	98·5	0·6	1·4
1922-23	29·4	17·6	8·8	91·7	18·0	23·5
1921-22	21·8	10·2	18·2	83·6	0·0	0·0
1920-21	19·2	4·4	13·4	82·6	30·0	10·0
1919-20 ...	18·9	3·4	15·4	81·1	10·1	0·0
1918-19	27·3	12·1	36·6	90·9	10·1	—

	ALSIKE	WHITE CLOVER			ALSIKE AND WHITE	LUCERNE
		All samples	Mid-European	New Zealand		
1935-36	**0·0**	**0·5**	**1·9**	**0·0**	**2·7**	**3·2**
1934-35	0·0	0·4	0·0	0·0	1·0	8·4
1933-34	0·0	0·0	0·0	0·0	1·0	5·1
1932-33	0·0	0·0	0·0	0·0	1·3	6·7
1931-32	0·0	0·1	0·0	0·0	2·4	9·4
1930-31	0·5	1·3	5·1	0·0	5·9	8·6
1929-30	0·6	0·6	4·4	0·0	9·7	8·7
1928-29 .. .	1·6	0·1	6·1	0·0	0·7	9·4
1927-28	0·0	0·1	5·6	0·0	0·0	5·9
1926-27 . .	0·0	0·4	2·1	7·1	5·8	5·7
1925-26 ...	0·0	1·5	0·0	12·5	0·0	11·3
1924-25	1·3	5·6	12·9	37·5	2·9	12·5
1923-24	1·0	2·4	0·0	66·6	2·0	11·1
1922-23	4·1	17·6	5·0	48·3	22·2	11·5
1921-22	6·4	4·5	3·5	25·0	7·9	7·3
1920-21	5·5	3·4	12·5	9·4	16·1	12·3
1919-20	6·1	3·1	11·1	0·0	13·6	12·2
1918-19	less than 1·0	1·3	—	—	less than 1·0	6·7

A dash sign, thus —, in this table indicates that no samples were received.

VARIETIES OF CEREALS.

The distribution of cereal samples, according to variety, is shown in Table IX. Although the figures recorded do not necessarily represent the areas sown with the different varieties, yet they give an indication of relative popularity. Samples are sometimes received at the Station bearing no varietal name, so that two sets of figures are shown for each variety in the table; one set gives the percentage occurrence amongst all samples and the other

the percentage amongst named varieties only. Only those varieties are included which are present to an extent of at least 0·8% of all samples.

In the wheat group a significant change is shown in the position and percentage occurrence of Red Marvel, when compared with previous seasons. This was to be expected, in view of the unprecedented demand for this variety in the spring of 1936. Barley varieties show little significant change amongst the first few varieties, over the past few years. In the Oat group Grey Winter has steadily risen and White Winter fallen somewhat during the past three years.

Table IX. *Shows distribution of cereal samples according to variety.*

	Percentage of total	Percentage of named varieties		Percentage of total	Percentage of named varieties
		WHEAT.			
Little Joss	14·1	16·2	Renown	1·7	2·0
White Victor ..	10·9	12·6	Squarehead ...	1·5	1·7
Red Standard ...	8·7	10·0	A.1.	1·3	1·5
Red Marvel	8·7	10·0	Miller	1·2	1·4
Squarehead's Master	6·6	7·6	Rivett	1·1	1·3
Wilhelmina .. .	6·3	7·2	Redman	1·1	1·3
Yeoman . .	5·3	6·1	Chevalier	1·0	1·2
Garton's "60" .	2·7	3·1	Million III ...	0·9	1·1
Squarehead II ..	2·2	2·6	Other named varieties	9·1	10·5
April Bearded ..	2·2	2·6	Not named	13·4	
		BARLEY.			
Spratt Archer ..	20·1	37·4	Golden Archer ..	1·8	3·4
Plumage Archer ..	15·8	29·5	Standwell	0·9	1·7
Plumage	3·6	6·7	Other named varieties	7·0	12·9
New Cross	2·6	4·9	Not named	46·3	
Beaven's Plumage ...	1·9	3·5			
		OATS.			
Victory ...	17·6	20·5	Black	2·4	2·7
Abundance	8·1	9·4	Superb .	2·0	2·3
Grey Winter ...	5·9	6·9	Onward	2·0	2·3
Marvellous	5·8	6·8	Unique .. .	1·5	1·7
Black Winter ..	5·8	6·8	Golden Rain ...	1·5	1·7
Black Supreme ..	4·5	5·2	Prolific . ..	1·2	1·4
White ..	4·5	5·2	Black Sprig	1·2	1·4
White Winter .	4·0	4·7	Resistance	1·0	1·2
Black Tartar ..	4·0	4·7	Potato ..	0·8	1·0
Yielder	3·1	3·6	Other named varieties	6·5	7·5
Star	2·5	3·0	Not named	14·1	

SEED-BORNE DISEASES.

A. Diseases of Cereals.

Examination by naked-eye, for the presence of certain seed-borne diseases, has been made of all samples of wheat, barley and rye received during the season. Figures showing the percentage of samples with "naked-eye" evidence of infection are given in Table X, together with comparable figures for the previous season. The cereal samples examined would have

been derived almost entirely from the harvest of 1935. "Bunt balls" and "earcockles" were found to be present in wheat samples to a less extent than in any previous season. The percentage of barley samples containing smutted grain is a little lower than in the previous season and rye samples containing ergot show a percentage figure lower than in most previous years. Where ergot was reported in samples the actual amount present per infected sample was small and in the majority of cases was by weight only a "trace".

Table X. *Shows percentage of cereal samples with "naked-eye" evidence of disease infection.*

	1935-36 per cent.	1934-35 per cent.
Bunt in Wheat—*Tilletia Caries* (DC.) Tul.	**2·4**	4·1
Earcockles in Wheat—*Anguillulina tritici* Gervais and Beneden. ...	**1·6**	2·3
Ergot in Wheat—*Claviceps purpurea* (Fr.) Tul.	**0·6**	0·3
Smut in Barley—*Ustilago Hordei* (Pers.) Kellerm. and Swing. ...	**4·9**	5·3
Ergot in Barley—*Claviceps purpurea* (Fr.) Tul.	**0·0**	0·0
Ergot in Rye—*Claviceps purpurea* (Fr.) Tul.	**8·8**	9·6

B. Diseases of Celery.

40 samples of celery seed were submitted for special examination for the presence of *Septoria Apii* Chester (Celery leaf spot) during the season and these samples were also examined for *Phoma apiicola* Kleb. (Phoma root rot). The following table shows the number and percentage of samples falling within certain limits of infection, as determined from the presence of pycnidia upon the "seed".

Table XI. *Shows number and percentage of celery seed samples infected with Septoria Apii and Phoma apiicola.*

Range of infection per cent.	*Celery Leaf Spot.*		*Phoma Root Rot.*	
	No. of samples	No. of samples as percentage	No. of samples	No. of samples as percentage
Nil	3	7·5	24	60·0
1—5	18	45·0	15	37·5
6—10	6	15·0	1	2·5
11—20	4	10·0		
21—30	0	0·0		
31—40	1	2·5		
41—50	2	5·0		
51—60	0	0·0		
61—70	3	7·5		
71—80	3	7·5		

C. General.

Several samples of wheat were received during the season, to be examined for adhering spores of Bunt (*Tilletia Caries* (DC. Tul.). *Helminthosporium Avenae* (Bri. and Cav.) Eid.—Leaf Spot of oats—developed upon a number of oat samples during the course of the routine germination test and special examination upon request, was made for the presence of this organism in a few cases. *Ascochyta Pisi* Lib. was recorded upon a relatively large number of pea samples and samples of peas were submitted for examination for " Marsh Spot ". Specimens of bunt balls, ergots, ear-cockles and sclerotia were received for identification, with requests in many instances for information concerning the organisms responsible.

MOISTURE CONTENT OF SEED SAMPLES.

251 samples were submitted for moisture content determination during the season, a greater number than in any previous season. This number was made up as follows :—

Wheat	91	samples
Peas	19	,,
Sugar Beet ...	137	,,
Mangold	2	,,
Turnip	2	,,

During several preceding seasons a varying number of chewing's fescue samples had been received from the New Zealand Seed Testing Station and moisture content determinations and germination tests made upon them, in connection with an investigation being conducted by the New Zealand Station into the causes of the loss of vitality of this seed experienced during its transit from New Zealand. This work was completed in 1935 and no further samples were received during the season under review. The increased number of samples received for moisture test during the season is due to the greater number of sugar beet samples submitted, approximately 60% of which came from sugar beet factories.

The moisture content of seed plays a part in fixing the price of certain seeds and is of importance in connection with field trials of cereals. It is, however, perhaps not always fully appreciated how great a part the moisture content can play in the complex question of loss of vitality of seeds. Too high a moisture content of stored seed, apart from the obvious risks, invariably leads to more rapid loss of vitality and in this connection the Station has in course of preparation, data showing the average moisture content of " air-dry " seed of most of the species listed in the Seeds Regulations 1922.

WILD WHITE CLOVER CERTIFICATION SCHEME.

During the season 1935-36, the sixth year of the Scheme's operation, the number of samples of seed-heads collected from inspected pastures and received at the Station for the purpose of the " growing-on " test, fell to 15. The seed from these " head-samples " was rubbed out, scarified and sown in September 1935, the resulting plots being examined and reported upon in the early summer of 1936, by the committee especially set up for this purpose. The total number of plots sown from " head samples " collected

during the first six years of the scheme has reached 890. In addition, during this period, 103 " type samples " of seed from fields finally certified under the scheme, were received at the Station and plots sown down from them, bringing the total of plots sown in connection with the scheme up to 993.

INVESTIGATIONS.

A. *Routine Investigations.*

As noted earlier in this report, a total of 2,035 tests of an investigational nature were undertaken during the season. These tests were all conducted in connection with certain investigations which go on from year to year or as a result of problems which presented themselves for solution during the course of the season's work.

B. *Special Problems.*

Organic mercury compounds in the form of seed dressings have become widely used for the control of certain seed-borne diseases of cereals and are in certain instances likely to be of considerable protective value when applied to other seeds. From enquiries received from time to time it is evident that little published information is available regarding their relative toxicity to seeds other than those of cereals, sugar beet, mangolds and peas. Work has now been commenced to investigate the toxicity of such dressings at different rates of application to certain smaller seeds.

Work has already been done to determine the effect upon the " keeping quality " of cereals, especially wheat, after having been treated with organic mercury seed dressings and this work is now being further extended.

From time to time the Station is asked to conduct greenhouse soil tests upon pea samples, in addition to tests by the standard laboratory method. To be of value such tests should be conducted in a uniform manner, and under controlled conditions, and in this connection a considerable number of tests have been made upon bulks of peas of varying quality, in order to compare results by the standard sand method, with those from tests made under various " greenhouse " conditions. The effects of a number of factors such as depth of planting, nature of medium and degree of moisture of seed-bed have been investigated.

Arising from an enquiry concerning a crop failure of peas, an investigation was undertaken to determine the toxicity to peas of those arsenical salts and compounds available to the public. It was found that in certain concentrations, arsenic in some forms is highly toxic to peas.

GENERAL.

Throughout the season a number of requests for information concerning various aspects of seed analysis were received, covering methods, apparatus, etc.

The Station was of service throughout the year to farmers, seedsmen and other enquirers who submitted specimen plants and seeds for identification. Many of the former were not complete plants, but portions or even fragments of leaves and stems; others were portions of plants with or without flowering and fruiting parts. In some cases the material was received in a

dried up and damaged condition and much skill was needed to restore the specimens to such a state as to render visible any identifiable features.

Information as to the habits, duration and possible possession of injurious and/or poisonous properties of many weed plants was given and advice upon the eradication of weeds was solicited and given on several occasions.

Seed specimens requiring identification were also received from many sources. A few senders now make a habit of collecting their seeds to be identified and despatching them in batches to the Station at intervals during the year. Seeds of many interesting and little known foreign as well as native species were received for determination and in these instances the value, for reference purposes, of the Station's seed collection was demonstrated. This collection has been augmented from time to time and now comprises some 4,100 different species and varieties from all parts of the world. In addition the Station has built up a smaller collection of " duplicate " seed samples, from which a growing demand for weed seed specimens is being met. A certain amount of " seed exchange " has been conducted with Institutions and Seed Testing Stations abroad and in the Dominions.

The identification of plant and seed specimens has sometimes been made difficult by the inadequate manner in which the material has been packed by the senders, which has resulted in the packages becoming so damaged in transit, that the contents were either missing or else broken into unrecognisable fragments. Identification by the Station would be materially assisted if all plant specimens were packed in containers lined with moistened material and if seed specimens were protected and packed in such a way as to ensure their being received at the Station in an undamaged condition.

MEETINGS OF THE FELLOWS OF THE INSTITUTE.

FIFTEENTH ANNUAL GENERAL MEETING.

The Fifteenth Annual General Meeting of Fellows of the Institute was held at Cambridge on the 16th July 1936. Sir A. Daniel Hall, Chairman of the Council, who presided, submitted the Sixteenth Annual Report of the Council and the accounts for the year 1934-35, and it was unanimously agreed that they be received. An address was then given by the Chairman on the work of the National Institute of Agricultural Botany. This is printed below. The rest of the meeting was occupied by the inspection of the exhibits in the Official Seed Testing Station and the work in progress on the Headquarters Trial Ground.

THE WORK OF THE NATIONAL INSTITUTE OF AGRICULTURAL BOTANY.

There are just a few points in connection with our work which I should like to say a word or two about. In the ordinary way we have merely to report that the Institute has been working quietly and satisfactorily throughout the year; nothing outstanding has happened. The Annual Report gives you a description of the work that is being carried on, its general objectives are what I am going to talk of.

Now of course one of our prime objects, and perhaps the Institute started more hopefully in that particular respect than it feels to-day, was to serve as a medium for introducing new varieties of farm crops to the public. We expected to receive these new varieties on the one hand from the trade and on the other hand from the Plant Breeding Stations in Cambridge and elsewhere. Any new variety that they arrived at would through our machinery be subject to an accurate test so as to measure, or at any rate to compare, its value to the farmer with that of other standard varieties of that particular crop. Then we would be able to perform the intermediary function of multiplying the stock of that new variety from the experimental stage in which it had left the Plant Breeding Station to a commercial stage, so that we could then offer it to the seed trade whereby it could go out to the public with a real guarantee of its performance, with its excellencies and its defects thoroughly well tested. At any rate the public would not be buying something whose performance rested solely in the skill of the man who drafted the advertisement. Well, that, as I say, was one of our prime objects, and we rather expected that we should have a good deal of work of this description to do and that this would become almost the chief function of the Institute. Well, we have introduced some new varieties, but it is by no means usual to find a variety which when put through our testing mill would justify us in bulking it and recommending it to the public through the medium of the

seed trade. The new varieties which are able to compete with those customarily grown in the country are by no means so numerous as in the first instance we had been led to expect. I, least of all, should want to belittle the efforts of the plant breeder, but we have got to recognize that when we are dealing with cereals grown in this country, with barley and oats, plants which have been for many hundreds of years subject to what was perhaps only a rough means of selection, yet are plants which have very nearly reached the capacity of production of which they are capable. We really cannot expect to produce a new wheat that is going to yield 20 per cent. more than some of the older wheats which were being grown even fifty years ago. Improvement of that kind is probably out of our reach altogether. The sort of improvements that we have to expect are increases in yield in the order of 5 per cent., which can only be detected by careful testing. There is, as it were, and must be, a natural limit to the power of a given species of plant to give us production, other conditions of the soil being equal. Increase of quantity will perhaps be more due to fertilizers than to new varieties. On the other hand, we do recognize that if we do not merely fix our eyes upon yield, there are many qualities where our plants are still subject to a considerable measure of improvement.

In the case of our cereals, for instance, one character upon which the plant breeder is fixing his attention more and more at the present time is the strength of the straw, and that of course is so, particularly in this country, where we are trying to intensify our farming and to use more fertilizers. We need varieties which will stand up under a good weight of crop which has been produced by high fertility. Another feature of prime importance which is not being overlooked by plant breeders is resistance to disease, because again we always recognize that as the intensity of the cultivation increases, as more fertilizer is used, as bigger yields are sought for, there comes a greater susceptibility to disease. Thus the work of the plant breeder becomes directed to these secondary characteristics of strength of straw and resistance to disease, and it is in these directions that the results of our trials and our testing scheme are most likely to give information in the future.

Even quality in some of the cereals is not perhaps of so much importance as at one time we were able to consider it. It is unfortunate that all the immense improvements that Sir Rowland Biffen has effected in the quality of wheat are no longer reflected in a reasonable increase of price correlative to the improvement in the wheats. At the present time what is most marketable is some of the softest and whitest of English wheats, because the poultry man is a better purchaser than the miller. Thus the Institute has been compelled to alter its views in the light of its experience since its foundation; the intermediary testing and bulking process between the pure plant breeder and the commercial introduction of seed has not become so large a feature in our programme as at the first we expected. However, as I say, it is a feature of our work, and from time to time these new introductions are being bred, for you get in the report an account of one wheat, Holdfast, raised by Professor Engledow that has been distributed to a certain limited extent during the past year. Yet that wheat is not being put out as a wheat for general cultivation, probably it will not ever be very universally grown, but it has this character of very stiff straw, and in consequence it does fill a

gap for the rich soils and high cultivation. With the introduction of Resistance we can report some progress with one much needed crop, a better type of winter oat. We know that as farming has changed in the south and east of England winter oats fit in with the scheme of cultivation very often better than spring oats. However we have always known that the winter oats that we had available did suffer from a great weakness of straw, and so the efforts of the plant breeders have been directed towards getting heavy yielding winter oats with a better hope of standing up. I noticed as I came along to-day a field of winter oats, that I thought, looking at it from the train, was ready to cut, but had been badly knocked about by the heavy rain storms. We need a winter oat that will resist at any rate the sort of storms that are likely to come towards the end of July. We have under trial at the present time three other varieties of winter oats that give us promise of yield and good straw, but they are not yet sufficiently tested, nor have they been grown for multiplication.

Leaving the question of the introduction of new varieties, probably the chief section of the work of the Institute is the conduct of the trials of both new and existing varieties. We hope to characterize and to give the farmer exact information as to the yielding capacity and the general behaviour of this or that new variety which is being introduced to his notice. These trials were the first systematic trials in this country to be carried out on an exact scientific system, whereby the error that comes with the comparison of two plots side by side of a given wheat or a given barley can be reduced to manageable proportions. We claim that the results that we get from our system of making trials, though they involve a good deal of labour, do get the error down to something in the region of 2 per cent., low enough therefore to enable us to pick out a variety which would give a 5 per cent. improvement in yield over the standard variety with which it is compared. Of course a 5 per cent. increase, if we can get it, is a matter of very considerable commercial importance to the farmer. These trials are designed to give an idea of the value of the variety within that sort of limit of error, and of course in our tests we try out the variety not for one year only, but up to three years or even more, so as to reduce as far as possible the variations that may be brought about by weather and season. To a certain extent, this rather laborious system of trials that we have adopted is a criticism of the way that a very large number of experiments over long periods of years had been carried out in this country without due regard to the sort of errors that inevitably creep in. We know how contradictory many of these early results had been, so that we claim for our method that we have now devised a method of a measurable degree of accuracy. We have not only a central trial ground here, but different centres about the country, and we pride ourselves that our results are reasonably accurate and that they hold over the greater part of the arable land of the country.

We are always looking out for improvements in the technique of the method of conducting these plots, in order to minimize the many sources of error that occur. We are always glad of criticisms from people who have seen the trials and are thinking about them, as to the possible sources of error that we may have overlooked; things like the management of the seed drill, rate of delivery of the seed, and so forth. All these points have to be very carefully considered if you are going to make a really sound trial.

We have been considering of late whether we should not increase the range of the crops that we are accepting for trial. You see, farming is never at a standstill; it is always undergoing considerable changes, and we do recognize that in the arable districts farmers are looking out for new types of crops. Many of them are beginning to expand into the various crops normally regarded as only belonging to the market gardener, adding vegetable crops, perhaps only a field here and there, but still something new in the old standard routine of the farm. There is no doubt a growing public demand for more vegetables in the dietary, a very right and proper change in the habits of the people, and naturally enough a farmer, seeing from time to time the good money which is made by those who supply these crops, is inclined to put in a field or so of vegetables. The market gardener grumbles a little that his thunder is being stolen. Still, in his turn he has got to strive towards finer and more difficult types of vegetables.

We thought it well to consider the introduction of various types of vegetables which are grown on a field scale by some farmers, and we have picking peas in our trials for the first time. They have already yielded some information, but perhaps it is more information for the design of further trials than anything that we can yet put before the public.

There is one other crop that we have also introduced into our trials, and that is chicory. While it is not a widely grown crop, is not even a crop that can be grown on a large scale, the demand for chicory in England not being so large as all that, still it is a marketable product, and I am glad to say that at any rate two of the most considerable firms who have been growing chicory in this country have agreed to co-operate in these trials and share the results that may come from them. It is quite a large crop in some countries, in Belgium and Czechoslovakia, and there is no reason at all, as far as we can see, when we have been able to determine the variety that should be grown in this country, why it should not be, on a small scale, a profit returning crop here at home.

I may allude again to one important branch of our work, and that is the various trials of potatoes that are not carried on here, but at the separate sub-station which we have at Ormskirk. For many years, of course, the trials at the Ormskirk station have been the machinery by which new varieties are tried out for their immunity or otherwise to wart disease. The checking of the disease in fact has been largely due to its work. There was a time, about 1916, when the spread of wart disease was becoming so rapid in this country that it looked as if the growing of potatoes might be wiped out. There was no means of dealing with the disease by treatment, and the soil remained for years and years infected. Nor is there any practicable method of ridding the soil of infection. Then it became known that certain varieties were immune, and from that starting point the plant breeders have produced immune varieties which have replaced the older susceptible varieties. With one or two exceptions, like King Edward and some of the earlies, no susceptibles are now grown. Ormskirk, which abounds with the infection of wart disease, forms a magnificent testing station, from which results may be obtained which will enable a certificate of immunity to be issued. The work is going on, and there we have a very active Committee of potato experts under the Chairmanship of Dr. Salaman. We can report this year one item of progress. We have long deplored the fact that some seedsmen were in

the habit of putting out as new varieties potatoes which when examined turned out to be some old variety. Synonyms, in the potato world, abounded. One of the features of the work of the Ormskirk station has been to ascertain as far as possible these synonyms, and point out to the public the fact that a Golden Star, we will say, that appeared in Messrs. XYZ's catalogue, was nothing but a re-named Up-to-Date. When we began there was a good deal of dissent to this rather drastic action on the part of the Institute. There were even threatenings of slander actions and so forth, but I am glad to say we have lived all that down, and thanks to the steady publication of synonyms, thanks to the work that Dr. Salaman and his colleagues undertook, I think every seed potato selling firm of repute in the country has at last agreed that they would conform to the statements that the Institute made about synonyms and would withdraw from their catalogues and lists all their so-called new varieties. We have succeeded with very few exceptions indeed in clearing out the synonyms which used to disfigure the lists of varieties of potatoes.

The success that the Potato Committee working at Ormskirk have had with regard to the synonyms that exist in potatoes leads me on to the question which is still a matter of some importance—the similar action that the Institute is taking with regard to cereals and other farm seeds. At head-quarters and the sub-stations we grow a large number of varieties, new and old, merely as observation plots, not for a determination of yield but to allow farmers to see for themselves what any variety looks like. Our Recorders keep these varieties under very close observation during their growth and so are able to arrive at conclusions as to whether any new introduction is indistinguishable from an old variety which may be growing alongside. In that way we have been able to label a number of recent introductions as synonyms, and declare that they were no more than an old variety which had been re-introduced with a fresh name. That, and again some of our reports about the yielding power of this or that variety, has drawn down upon us a certain amount of criticism from the representatives of the seed trade. They have, I will not say quarrelled, but they have criticized, and said " You are really being very unkind to us; after all, the Seed Trade Association was one of the bodies which helped to found this Institute and contributes towards it by sharing in the Fellowship. We do not quite see why you should turn round and blacklist some of our members as growing things under a false name. We rather object to the way you go to work in this matter ". Well, we only want to live in amity with the seed trade. We know very well that it is through the seed trade that the farmer gets his seed in the first instance, and that our success will be very largely bound up with the degree of co-operation which we can show with the seed trade, and therefore we do not want to do anything that could be adverse to the real interests of the trade. So we have called a meeting with their representatives to discuss more fully their criticisms, and see if we can arrive at a plan to adjust matters so that they should no longer feel aggrieved. We must hold to our purpose, and where we do find a case of a synonym we must let the public know about it, for after all, this Institute is founded not for any one trade or interest, but in the interest of the farmers. Thus we have to bring information to them, and nothing can deter us from that prime purpose. We and the seed trade itself exist for the benefit of the farmers, and our

methods, however distasteful they may be at the time to individuals are yet measures which are taken in the interests of the seed trade itself. They can only proceed on a basis of obtaining the confidence of the public in the statements that are put out, and therefore we want to carry them with us. We are prepared to study any method of presentation that shall not seem to tread unnecessarily upon the toes of individuals, still less to put a black mark on the trade as a whole, but our object is to make the farmers feel that the proposals which are made in the trade catalogues can be thoroughly trusted. That will be all to the benefit of the best representatives of the seed trade itself. I have perhaps dwelt at too great length on this slight disagreement which has arisen between ourselves and some of the representatives of the seed trade, but we want to get to the bottom of it as quickly as possible.

I would remind you, however, that very similar criticisms were made some twenty years ago, when the Seed Act was first introduced, and the seed merchants were first of all in this country compelled to make a statement about the germination capacity and the purity of seeds. There again it was objected that various people were being criticized, were being labelled and shown up as doing something that was contrary to the law that had been passed. Well, now I am glad to say that owing to the working of the Seed Testing Station, which is a function of the Ministry of Agriculture, but a function which has been delegated to this Institute, all that kind of criticism has died away entirely. The seedsmen realize that in the Seed Testing Station they have a piece of machinery which gives them information that can be trusted, information upon which they can base their commercial dealings, information which will guarantee to the farmer the class and quality of the seeds he buys. The seed trade have obtained confidence in the work of the Seed Testing Station and in the way its Chief Officer, Mr. Eastham, is always ready to give help and advice.

As we are talking about the Seed Testing Station I can report that it is having a very successful year. Already only eleven months of its normal working year have elapsed, but it has had through its hands in those eleven months something like 5 per cent. more samples to test than it has ever had before during a period of twelve months. That shows how steadily the confidence of the trade is increasing in the reports they get. Another thing which I believe the Seed Testing Station is rather proud of is that they have been receiving, I will not say a large number, but still an increasing number, of samples from American seedsmen, who formerly when they wanted to get an exact measure upon which they could declare the condition of their seeds would send it to Zurich, the oldest seed testing station. This is a sign that a certificate from our Station is regarded as of great value in the international seed trade. Well, as I say, that is a little bouquet which has been thrown to the Seed Testing Station here.

Well, now, gentlemen, there is only one other thing that I would like to talk about, and that is a matter which for some years has been giving the Council a certain amount of uneasiness. We derive the greater part of our income from Government sources, yet of course we have a private source of income in the subscriptions of the Fellows. Well, our Fellowship list is not large and is not increasing; in fact, it is slowly shrinking. We lose each year more than we gain, perhaps ten more than we gain. I consider that

this is wrong, and I should be very sorry to see the Institute develop into a purely bureaucratic body, responsible only to the Government. I should be very sorry not to retain our contacts with the men in the trade, with seed growers and millers, and on the other hand the farmers. We want them to remind us of things that we may do for them, we want their criticisms, and more than ever we want their support. Therefore I think it is of the utmost importance that we should try in every way we can to strengthen our Fellowship and to give this body a real democratic constitution, in which the people who are using our work can see to it that we are doing all we can for them. Therefore I want to make a further appeal that all the personal Fellows here should use their influence to try and rope in more Fellows. We give the results of our work freely, we need publicity to bring them home to the farmer. We make a free distribution of our leaflets. We have come to an agreement, for instance, with the County Organizers that we will supply them with a number of copies of our leaflets so that if any farmers ask a question, " Well, what about such and such a variety of wheat? Is it the best one to grow?" he can pass over one of our leaflets where the farmer will read of the trials of that variety. So we dispose of a very large number of our publications in that way, over 70,000 of these leaflets are distributed free every year. That is all very well, but it is not bringing back the measure of support to our Fellowship that I think it deserves, for perhaps people think, " We can get all this free, so why should we subscribe?" The Council is again considering whether we cannot devise some method of enlarging the membership of this Institute. It is not so much a matter of funds, it is a question of strengthening what I call the democratic element in the constitution of this Institute so as to ensure eventually that our work does respond to the needs of the industry for which this Institute was founded.

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WILFRED H. PARKER,
Director 1919-1937.

FOREWORD.

It was in January 1927 that the First Foreword to the Institute's Journal was written. Year by year from that date the Foreword to each issue was written by the Director, Mr. Wilfred H. Parker. His sudden death, on the 11th January last, occurred whilst this number of the Journal was in preparation. It seems fitting therefore that the Foreword to this issue should be replaced by the following obituary notice which appeared in *The Times* of the 18th January, 1938.

MR. W. H. PARKER.

SPORTSMAN AND BOTANIST.

Mr. Wilfred Henry Parker died suddenly at Cambridge on January 11, after three months of ill-health, at the age of 49. He had been Director of the National Institute of Agricultural Botany for 18 years, where his unfailing courtesy and fair dealing endeared him to all.

Born at Christchurch, New Zealand, he was the only surviving child of the Hon. Edmund Parker, and grandson of the sixth Earl of Macclesfield. Educated at Lancing and Trinity College, Cambridge, he showed early promise as an all-round athlete and sportsman, and represented his university against Oxford at cross-country running. He hunted in Warwickshire and with the Fitzwilliam, followed the Trinity Foot Beagles, and was a member of the C.U.L.T.C. and of the Trinity VI.

In 1913 he married Audrey Peareth, daughter of Alderman T. R. Vickers, of Coventry. He was then Scientific Assistant to Sir Rowland Biffen at the School of Agriculture, Cambridge, and became Director of Agricultural Studies at Trinity College. In 1915 he enlisted in the H.A.C., and later was gazetted to the 11th Battalion, The Suffolk Regiment, with which unit he was awarded the Military Cross after the Battle of the Somme in 1916. He was sent as an instructor in sniping with the 2nd British Military Mission to the U.S.A. in 1917-18. He remained in close touch with his old battalion, and was an officer of the local branch of the British Legion. He was also Assistant County Director of the British Red Cross Society. His characteristic zeal and efficiency made him a recognized authority on his own professional subject, and brought him into consultation with the Ministry and with the seed trade, and at conferences abroad.

It is, however, as a sportsman in the true sense of the word that he will be remembered by his wide circle of friends of all ranks. As a shooting companion he was ideal. The size of the bag never counted with him; indeed he preferred duck-flighting—so often unsuccessful—to any other form of shooting, although he could hold his own with

the best team of guns partridge driving. He had a wonderful way with dogs, and his spaniels were the envy of most people; while to himself they afforded more than half the pleasure of the day's shooting. He was keen on everything he took up, and his interests were wide. He was a strong swimmer, an excellent bridge player, and a born naturalist. Latterly he devoted much of his leisure to golf, and could always be relied upon to turn out in the vilest weather. His great charm of manner, wise counsel, courage, sympathy, and sense of humour made him beloved by all who knew him. He leaves a widow and one son, Michael.

March, 1938.

COUNTY WINTER OAT TRIALS,

1935-36 AND 1936-37.

B. BRANDRETH, M.A.

In the autumn of 1935 County Agricultural Organizers and others were invited to co-operate in a series of trials of winter oats, for which purpose seed of Grey Winter, Resistance and S.81, the latter bred by the Welsh Plant Breeding Station, had previously been grown near Cambridge.

The suggested lay-out for each trial consisted of three quarter-acre plots of each variety arranged at random in three blocks and, wherever possible, the produce of each plot was threshed separately.

The number of counties which agreed to take part was smaller than in the earlier series of spring oat trials, partly on account of the smaller area under winter oats. Twenty replicated trials were finally sown in 1935, and ten in 1936; of these, the numbers which provided complete data were fourteen and eight respectively. A small number of single observation plots were grown and those trials which did not provide individual plot yields were also treated as observation plots.

In neither season was the weather such as to provide a general test of varietal resistance to bad weather conditions. It was observed that at some centres S.81 withstood the cold wet spring of 1936 better than Resistance, and Resistance was generally noted as suffering more from such conditions than either S.81 or Grey Winter, but no serious frost damage was reported.

Centres differed widely in type of soil, and it was clear that Resistance showed a greater response to high fertility than either Grey Winter or S.81. It was also superior in standing power, although there was comparatively little lodging in either season. Grey Winter was the only variety which was seriously lodged at any centre.

Tables I and II show the centres from which full returns from trials and observation plots were obtained, together with the total yields of grain. In roughly a third of the trials the difference did not reach statistical significance; this was generally due to irregularity in yield between different plots of the same variety, for the varietal differences tended to be high.

The average yields from both trials and observation plots show the same trend in each year, Resistance and S.81 giving similar yields and both outyielding Grey Winter. It is, however, noteworthy that under poor conditions, whether of soil or weather, S.81 generally gave a yield as high as, or higher than, Resistance, while under good conditions Resistance was usually the better variety. In no case did Grey Winter show a significant superiority.

SUMMARY.

Resistance, S.81 and Grey Winter were tested in 14 trials in the season 1935-6 and in 8 trials in 1936-7, as well as in a number of observation plots. There was some evidence that Resistance was less suited to cold, wet conditions in spring than either of the other varieties, and this was borne out by the fact that under such conditions S.81 usually gave the higher yield, while where fertility was high Resistance outyielded S.81. Grey Winter was outyielded by both of the other varieties and showed a much greater tendency to lodge. The winters were not severe enough to demonstrate its superiority in hardiness.

I. YIELD OF GRAIN, 1935-36.

County	Centre	Total yield of grain (cwt. per acre)			
		Grey Winter	S.81	Resistance	Significant difference
	Trials (¼ acre plots in triplicate).				
Bedfordshire	Harrold	13·8	17·1	16·8	5·0
Berkshire	Wokingham	3·8	7·0	6·7	0·7
Cambridgeshire	Quy	18·4	18·6	16·9	2·9
Devon	Seale Hayne	22·9	28·3	36·1	4·6
Hertfordshire	Oaklands	10·3	11·7	13·7	1·6
,,	Rothamsted	15·5	22·3	22·2	2·3
Kent	Wye	10·8	10·4	10·2	1·7
Middlesex	Napsbury	27·8	30·3	35·3	10·2
,,	South Mimms	16·1	13·7	14·9	10·2
Monmouth	Usk	17·3	20·2	20·7	2·9
Suffolk, East	Saxmundham	23·2	24·4	29·9	4·8
Sussex, West	Chichester	19·6	20·6	27·6	1·5
Warwickshire	Berkswell	15·3	16·7	12·7	8·8
Wiltshire	Marlborough	10·8	13·5	12·6	2·2
	Observation plots.				
Bedfordshire	Lidlington	12·9	24·2	19·6	—
Glamorgan	Pencoed	9·9	20·4	21·9	—
Gloucestershire	Cirencester	10·9	10·5	11·1	—
Suffolk, West	Higham	10·5	9·8	9·8	—
Warwickshire	Wellesbourne	20·7	26·0	29·2	—

II. YIELD OF GRAIN, 1936-37.

County	Centre	Total yield of grain (cwt. per acre)			
		Grey Winter	S.81	Resistance	Significant difference
	Trials (¼ acre plots in triplicate).				
Bedfordshire	Honeydon	10·8	12·6	10·8	1·4
Cambridgeshire	Swaffham Prior	20·9	23 1	26·2	4·1
Devon	Seale Hayne	20·9	24·2	18·4	3·9
Hertfordshire	Oaklands	16·9	19·7	20·2	8·2
Lincs. (Lindsey)	Fiskerton	17·1	19·0	24·0	6·5
Monmouth	Usk	18·5	24·5	24·0	2·7
Warwickshire	Tamworth	14·6	19·8	17·2	6·8
West Sussex	Chichester	18·2	19·0	22·6	8·6
	Observation plots.				
Bedfordshire	Lidlington	19·2	20·7	30·0	—
Berkshire	Long Wittenham	21·0	23·9	25·8	—
,,	Tilehurst	12·9	19·1	17·3	—
Glamorgan	Pencoed	8·9	17·9	20·3	—
Gloucestershire	Cirencester	20·3	28·8	20·3	—

TRIALS OF AUTUMN-SOWN WHEATS, 1931 — 1937.

S. F. ARMSTRONG, M.A.

The present report is intended to record the results of the Institute's autumn-sown wheat trials over the period 1931-1937, and to summarize the conclusions reached with regard to the varieties Starling II, Sun III, Victor, Brown's B.03561, Brown's 15/100, Renown, Gartons' 60, Steel, Juliana, Redman, and the Cambridge P.B.I. Wheats Rivett 25, Holdfast, 162/8/1E, 162/55/1 and W.70E. The other varieties mentioned in this report have either been discarded or are being further tested.

Trial Methods and Choice of Controls.

During the period here reviewed considerable changes were made in the methods of trial used. In the Institute's first wheat trials Squarehead's Master was chosen as the constant control since it was the variety most widely grown; it was used as the only control for a number of years, and is still employed as such when it appears to be suitable. It soon became apparent, however, that different types of wheat require other controls against which they can be more suitably matched. For example, Rivett, Iron, and similar late wheats require late ripening controls. It was found, too, that Squarehead's Master was unsuitable as a control when the effects of intensive manuring were being tested. For such reasons Squarehead's Master, in the period under review, has to a large extent been replaced by other controls more suited to the variety under test and to other circumstances.

Changes have also been made in the lay-out of some of the trials and in the shape of the plots. The half-drill strip method of trial is no longer rigidly followed. Under intensive manuring it was found that when this method — with its narrow strips — was used, the weaker strawed varieties frequently interfered with the growth of adjacent ones through lodging on them. For this reason plots relatively shorter in length and greater in width have accordingly been used in the high-farming trials; at first these were laid out in Latin squares, but with the increase in the number of varieties tested the randomized block method was adopted. The latter form of lay-out was also used when a group of similar forms were being tested, as for example, selections of Little Joss or Rivett wheats.

Manurial Treatments.

In the *normal trials* the manurial treatment followed the usual custom of each district. Some of the stiffer strawed varieties, however, were obviously suited for higher levels of fertility. The so-called *high-farming trials* were therefore planned to test such varieties, and in these trials an attempt was made to fertilise to the practical limit, i.e. to a limit where the straw-standing

capacity would be definitely tested and beyond which serious lodging might be expected. In each case the Institute consulted Sir John Russell, Director of Rothamsted Experimental Station, as to the most appropriate treatment. Usually the extra fertiliser applied was from 1½ to 2 cwt. of sulphate of ammonia, or 2 cwt. of nitro chalk per acre, such as would commonly be used by farmers who wished to raise the yield of the crop with the minimum of trouble and outlay. Since, however, the soils, previous cropping, etc. were not always identical for both the normal and high-farming trials brief particulars of these, and of the manures applied, are given in Tables I and II. The general character of the seasons is noted below, and reference is made to any factor that is known to have seriously affected the results.

TRIALS IN 1931-1932. (Table III).

Sowing was completed within the normal period, the earliest being at Cannington — October 24th — and the latest at Kirton — November 18th.

Sunshine was much below normal during the summer months. Although the sowing conditions were normal, and the weather on the whole favourable to growth, prospects of good crops were doomed by severe storms of wind and rain in June and July which caused much lodging. These, and various other causes, led to rather low yields at all centres except Cannington and Newport, and few reliable results were obtained. Severe yellow rust attack and lodging reduced the yield of Yeoman (W.165D) at Cambridge, where Holdfast was definitely more resistant to the disease and stood better. At Kirton also Yeoman lodged to a greater extent than Holdfast.

At Good Easter a very fine tilth and rich soil produced an extra thick " plant " and serious lodging occurred during a storm in late June. A trial of Renown v. Squarehead's Master was so badly lodged at that centre that it could not be harvested. The additional nitrogen applied to the intensively manured Iron III and Steel trials was not needed, and actually did harm. The yield results of these two trials are unreliable and are given for record only in Table III.

At Cannington the crops were very healthy, but as all the varieties were severely lodged several weeks before harvest the results must be accepted with reserve. Slug damage during the winter months was responsible for the low yields in the Steel and Starling II trials at Long Sutton. At Newport the yields in the intensively manured trials were poorer than those in the normal trials alongside and cannot be considered reliable; Iron III had too thin a " plant " to produce a normal crop.

At Sprowston, trials of five selections of Little Joss were a failure owing to heavy storms of wind and rain in June and July, which completely laid the crops and led to serious loss of grain by sparrows.

TRIALS IN 1932-33. (Tables IV and X).

The rather wet autumn of 1932 was succeeded by an exceptionally warm, dry summer, which—except on light land—was very favourable for the wheat crop. The trials at Long Sutton were sown late in November, and this, with an attack of wheat bulbfly, affected the yields at that station. At the remaining centres drilling was done between the 18th October and the 14th November. The light crops at Cannington were due to low soil fertility.

At Sprowston both rust and *Fusarium* sp. were noted on all varieties. In the high farming trials the rust attack was especially severe on 162/8/1E, while Holdfast and W.7OE were badly affected by " whiteheads ", probably caused by *Fusarium*. The greater intensity of these diseases explains why the yields in the high-farming trials at that centre were lower than those of the normal trials. At Newport some loss of grain occurred from the earlier ripening variety Holdfast in both the normal and high-farming trials.

TRIALS IN 1933-34. (Tables I and XI).

All the trials were sown by the first week in November, except at Kirton, where the trial was drilled on the 25th November, which is however a normal date for that district. October 1933 was wet, but the weather during the wheat growing period was favourable, the summer of 1934 being mainly warm and dry.

Wheat bulbfly caused considerable damage at Cambridge, where the high-farming trials and the normal trial of Holdfast failed owing to this pest. The low yield of 162/55/1 compared with its control at Cambridge also appeared to be due to its inability to grow away from the attack as rapidly as Squarehead's Master. At Long Sutton the Rivett trials suffered some loss of plant from wireworm, while the remaining trials at that centre failed from the same cause. Apart from the trials referred to above the yields were good; indeed at Newport, Good Easter and Cannington the yields were exceptionally high. In spite of the heavy yields only slight lodging was recorded, and this chiefly in the long strawed varieties like Squarehead's Master and Rivett. Even in the high-farming trial at Newport, where the threshed weight yields were between 40 and 45 cwt. per acre, only one variety—Steel— was inclined to lean over. No noticeable rust attack occurred anywhere.

TRIALS IN 1934-35. (Tables VI and XII).

A rather dry autumn enabled drilling to be done comparatively early at all stations. The winter was on the whole mild, but three exceptional spells of weather occurred during the growth of the crops. December was remarkably mild, wet and dull. During May a dry and bitterly cold period with severe frosts was experienced, so that the crops were backward in the spring in spite of the mild winter. July and August were very warm, dry months, and favoured the ripening and harvesting processes. Lodging was almost non-existent in the 1935 trials.

The yields were good except in the normal trials at Sprowston, where the dry, cold spring and very dry July severely taxed the crops on this light soil. Bad attacks of take-all (*Ophiobolus*) and *Fusarium* further reduced the yields at Sprowston. The much higher yields in the Sprowston high-farming trials, as indicated by a comparison of Yeoman II in both series, are worth noting. Although these trials were on rather better land it was clear that the large differences in grain yield were chiefly due to the stimulus received from the nitro-chalk applied in March; an excellent response followed, and the high-farming plots were not checked to the same extent as the normal ones by the cold weather in May.

TRIALS IN 1935-36. (Tables VII and XIII).

Although the winter was not severe, the weather for the rest of the season was unfavourable. April and May were cold dry months, and until the second week in August the weather was abnormally wet and dull. A fortnight's fine weather in August fortunately enabled harvesting to proceed in a normal manner.

All the trials were sown at normal dates for the different districts except at Newport, where the high-farming trials, following potatoes, were not sown until the 28th November. A long interval occurred between sowing and brairding, and the high-farming trials at that station were so backward and irregular that the results were unreliable.

The yields were only moderate at Long Sutton, Sprowston and Askham Bryan; and at Abbots Ripton, on a cold heavy clay, they were very low. In the remaining trials the yields were satisfactory. Lodging was not extensive anywhere, and rust was little in evidence. In the high-farming trials Little Tich, 190/101, Holdfast and Yeoman II showed most resistance to lodging in the order given, while Juliana and Benoist 40 lodged more than the others.

In the normal trials Brown's 15/100 stood decidedly better than Squarehead's Master, while Juliana stood rather better than Wilhelmina, and Yeoman II than Redman. In the Rivett trials all the selections stood reasonably well, though Rivett 25 stood more erect than the rest.

Of the varieties tested in additional trials at Cambridge and Littleport (Table IX), Little Joss and Wilhelmina lodged rather badly, especially on the fen soil. The new wheats 201 (26C) and 198 (20C) also lodged to a moderate extent, while the others stood well. In both these trials the crops were very heavy.

TRIALS IN 1936-37. (Tables VIII, IX and XIV).

The winter of 1936-37 was on the whole mild and very wet. The rainfall in December 1936 and during the first three months of 1937 was exceptionally high. For the rest of the wheat growing period the weather was more normal though, except for the month of August, there was a general deficiency of sunshine throughout the summer.

Most of the trials were sown during October, but those at Cannington and Littleport were sown between the 20th and 23rd November. The wet soil conditions reduced the yields in the Rivett trials both at Cambridge and Madingley. "Foot-rot" diseases were more in evidence than usual. One of the trials at Cambridge, including seven varieties in randomized blocks, was ruined by a severe attack in June of the foot-rot disease *Cercosporella herpotrichoides*. Serious attacks by this disease have hitherto been uncommon, and its severity in this instance was almost certainly due to the wet state of the soil in the late spring months. The trial of Robusta v. Juliana at Cannington failed through a severe attack of "Take-all" (*Ophiobolus*). At Long Sutton slug attacks reduced the yields of Yeoman II and Redman. In the remaining normal trials the yields at all centres were satisfactory and there was little evidence either of rust attack or lodging.

In the high-farming trials the yields were very high except at Long Sutton where slug attacks reduced the crops. Rust attack was marked on

several varieties at all centres except Askham Bryan, the severest attacks being on Little Tich. No serious lodging occurred.

QUALITY OF GRAIN.

The Home Grown Wheat Committee of the National Association of British and Irish Millers continued to make milling and baking tests of the wheats for breadmaking purposes until 1933, but owing to the death of Sir Albert Humphries no tests were made on the 1934 wheats. The National Association of British and Irish Millers have since very generously defrayed the cost of milling and baking tests undertaken by the Research Association of British Flour Millers on the wheats grown in 1935 and 1937, but unfortunately financial arrangements could not be made in respect of the 1936 crop. Their reports on the breadmaking quality of most of the wheats here dealt with are given in this Journal.* Their conclusions are referred to in the review of individual varieties given below. In addition to the baking tests, Messrs. James Nutter and Roger Clarke also compared the grain samples from all stations in each season, and valued them on the basis of the price which would be offered " at the farm ".

* See Vol. III, 42, 147, 259, 377, and Vol. IV, 147 and 266.

REVIEW OF INDIVIDUAL VARIETIES.

(Tables XV - XVII).

Starling II. (White chaff, white grain). This variety gave significantly higher yields than Squarehead's Master in six out of seven trials, its average yield being 10 per cent. higher. It gave relatively higher yields at Long Sutton than elsewhere.

Starling II ripens about the same time as Squarehead's Master, and its straw is 2 or 3 inches shorter and rather more resistant to lodging. Its grain is, however, inferior to Squarehead's Master for breadmaking and is invariably valued at a lower price.

Victor. (White chaff, white grain). This was tested against Wilhelmina in five trials. In two trials it gave significantly lower yields and in one a significantly higher yield. Its average yield was 97·6 per cent. of the control yield; the yield differences between the two were never very large.

In regard to its ripening period, length of straw and general field behaviour it is very similar to Wilhelmina. For breakmaking purposes its grain has also the same value as Wilhelmina, i.e. it is about equal to Squarehead's Master.

Sun III. (White chaff, red grain). This was tested at three stations in 1933. In one trial its yield was significantly lower than Squarehead's Master, and in the other trials not significantly different. Its average yield was 2 per cent. below the control; its straw was 3 inches shorter, and it ripened a few days later.

In baking tests its behaviour was better than Squarehead's Master, but its grain was valued at a slightly lower figure. In the field its only advantage over Squarehead's Master is its greater resistance to lodging. The trials were discontinued after 1933.

Brown's B.03561. (Red felted chaff, red grain). This new hybrid was tested at Cannington and Newport in 1932, and in both trials significantly outyielded Squarehead's Master, on the average by 11 per cent. In previous trials, there was no significant difference at Cannington in 1930, while at Newport its yield was significantly higher in 1930 and significantly lower in 1931. Its average yield in the five trials was about 5 per cent. higher than Squarehead's Master. Its straw was longer than Squarehead's Master and more resistant to lodging, but it ripened two or three days later and produced grain of similar quality. There was a definite tendency for its straw to remain green and immature some days after the grain was fit to harvest.

Renown. (Red chaff, red grain). This variety did relatively well at Cannington, where in 1930 and 1932 it significantly outyielded Squarehead's Master and gave on an average 16 per cent. more grain. At Good Easter in 1931 there was no significant yield difference, and in the following year at the same centre both varieties lodged so badly that the crop could not be harvested as a trial. Its average yield in the three trials was nearly 12 per cent. higher than Squarehead's Master, but at both centres its liability to lodge was an obvious fault.

Renown ripens about the same date as Squarehead's Master; its straw is of similar length, and the market value of its grain much the same as Squarehead's Master. The grain harvested in 1930 was tested for breadmaking and found inferior to Squarehead's Master.

Gartons' 60. (White chaff, red grain). Compared with Squarehead's Master this gave significantly lower yields at both Cannington and Newport in 1932. In the following year there was no significant difference at Cannington, while at Newport it gave a slightly higher yield that may be regarded as just significant. On an average of the four trials its yield was 96·2 per cent. of Squarehead's Master.

Gartons' 60 is similar to Squarehead's Master in length of straw and resistance to lodging; its grain also ripens about the same time and usually has the same market value.

Steel. (White chaff, red grain). This was tested against Squarehead's Master in ten trials under normal conditions of manuring. Its yields varied considerably from year to year. In 1930 it gave significantly higher yields than the control at each of the five trial centres. In the following year, in a dull wet summer, it suffered severely at Newport from ear blight disease (*Fusarium culmorum*), and at Sprowston it fared much worse than the control in competition with a strong growth of water-grass. At both these stations its yield was very much lower than the control. At Long Sutton there was no significant difference in yield. In 1932 it yielded well at Newport but poorly at Long Sutton.

If the 1931 results at Newport and Sprowston are excluded as abnormal its average yield in the eight remaining trials was 7 per cent. higher than the control, but on an average of all the trials its yield was only approximately equal to that of Squarehead's Master.

Steel was tested *under high farming conditions* in 1933 and 1934 against Iron III, and in the two following seasons against Yeoman II. In the ten trials with Iron III as control there was only once a significant yield difference, when Steel had a considerably lower yield; the average yield of Steel was,

however, 99·4 per cent. of Iron III. In the ten trials against Yeoman II the yield of Steel was once significantly lower and once significantly higher, and on the average was 98·4 per cent. of the control.

Steel ripens three or four days later than Squarehead's Master under normal conditions. Its straw is some 2 or 3 inches longer, but resists lodging much better. As a rule it is fairly resistant to rust, but in wet or late-ripening seasons it may suffer badly from that disease or from ear blight. Under high manuring its yields were not quite equal to those of Iron III or Yeoman II, and its longer straw was more liable to lodge than those varieties.

On fertile soils Steel is a heavy yielding wheat. Its grain is at least equal, and sometimes superior, to that of Squarehead's Master for breadmaking, being in fact of better quality than might be expected from its usual appearance.

162/8/1E. (White chaff, white grain). This new hybrid, produced at the Cambridge Plant Breeding Institute, was tested at all sub-stations in the three years 1933-1935. In the seventeen trials harvested it never once yielded less than Squarehead's Master, and in thirteen trials gave significantly higher yields; on an average its yield was 10 per cent. higher.

This variety was tested in ten trials *under high-farming conditions* against Iron III in 1933 and 1934. There were four significant yield differences, all in favour of 162/8/1E, and the average yield of the latter was 5·3 per cent. higher than the control. In six similar trials against Yeoman II in 1935, although there were no significant yield differences, the average yield of 162/8/1E was 6 per cent. higher than Yeoman II. In these high-farming trials it gave evidence of even better resistance to lodging than Steel, Iron or Yeoman II.

162/8/1E usually ripens a day or two later than Squarehead's Master. It has stout, short straw, from 3 to 7 inches shorter than Squarehead's Master, and exceptionally resistant to lodging. It is also highly resistant to rust. Its grain was valued at a slightly lower figure than Squarehead's Master, but it proved to be at least equal to that variety for breadmaking.

162/8/1E has great merits as a high yielding variety, and its excellent stiff straw makes it especially suitable for very rich land. Unfortunately, as the trials proceeded it was found that the grain colour was unfixed, and for that reason it could not be marketed. An endeavour is being made by the Cambridge Plant Breeding Institute to remedy this defect, in which case the wheat would again be tested for yield before marketing is considered.

162/55/1. (White chaff, white grain). This hybrid, also bred at the Cambridge Plant Breeding Institute, was tested against Squarehead's Master in eleven trials in 1933-35. On three occasions its yield was significantly lower, and on seven significantly higher, than the control. On the average its yield was 8·5 per cent. higher than the control.

162/55/1 was tested *in high farming trials* at four centres in 1934; it gave significantly lower yields than Iron III at two centres, and an average yield 5·5 per cent. lower than that variety. In eleven similar trials in 1935 and 1936 with Yeoman II as control, there were four significant yield differences, each in favour of 162/55/1, which gave on the average 7 per cent. more grain than the control.

162/55/1 behaved similarly to 162/8/1E as regards time of ripening, length of straw, and resistance to rust and lodging. It ripens two or three days later than Squarehead's Master and its grain has a similar market and breadmaking value.

Holdfast. (White chaff, white grain). This is derived from a cross between Yeoman and White Fife and was bred by the Cambridge Plant Breeding Institute. It was tested in fifteen normal trials in 1932-1934, a selection of Yeoman wheat, W.165D being used as control, and the trials were spread over seven centres. In these the yield of Holdfast was significantly lower in three and significantly higher than the control in six trials; its general average yield was 7·1 per cent. above the control.

Owing to its promising yields and resistance to lodging Holdfast was further tested *in high-farming trials* against Iron III in 1933 and 1934, and against Yeoman II in the two following years. In the ten trials against Iron III it gave significantly lower yields on four occasions, and its average yield was 10·8 per cent. lower than that variety. In eleven trials against Yeoman II its yield was once significantly lower and once significantly higher, its average yield being 1·3 per cent. higher than the control.

Holdfast ripens two or three days earlier than Yeoman II. It is also rather more resistant to rust than Yeoman, and its straw, which is from 2 - 5 inches shorter, is even more resistant to lodging. It compares favourably with Yeoman II for yield on land in good heart, and its grain is even better than that variety for breadmaking purposes and is much too strong for biscuit making. Its yield is lower than Iron III but its grain is altogether superior in quality.

W.70E. (White chaff, white grain). This hybrid wheat, bred at the Cambridge Plant Breeding Institute, was tested against Yeoman W.165D at six Sub-stations in 1933. In four of the trials it was significantly outyielded by Yeoman, and its average yield was 6·2 per cent. below that variety.

In the same season W.70E was tested against Iron III *in high-farming trials* at five centres. At two places its yield was very significantly lower than Iron III, and its average yield was 5·6 per cent. lower.

W.70E ripens about the same date as Yeoman, and is very similar to that variety in length of straw and in its resistance to lodging and rust. Its grain received a higher market valuation than Yeoman, and baking tests showed it to be a very superior breadmaking wheat, even better than Holdfast. On the other hand, owing to its comparatively low yield, it was not considered to be worth placing on the market.

Brown's 15/100. (White chaff, red grain). Was tested at Cannington, Sprowston and Askham Bryan from 1935 to 1937 against Squarehead's Master. It gave significantly higher yields than its control at Cannington, but at the Yorkshire station its yields were relatively poor. In the nine trials its yield was significantly better than Squarehead's Master in five and significantly lower in one trial. Its average yield was 103·6 per cent. of the control.

Brown's 15/100 is similar to Squarehead's Master in rust resistance, but its slightly shorter straw stands rather better and it ripens a day or two later. Its grain proved no better than Squarehead's Master for breadmaking, and was usually given a lower market value.

Redman. (Red chaff, red grain). This was tested with Yeoman II as control at four stations in 1934-35 and at six stations in the two following seasons. Its yield was significantly lower at Newport, but significantly higher at Cannington, in each of the three years. In the fifteen trials its yield was higher to a significant extent in five trials, but its average yield was only 100·8 per cent. of the control.

Redman ripens slightly earlier than Yeoman II and is similar to that variety in rust resistance, length of straw, and resistance to lodging. In every trial its grain was given a lower market value than Yeoman II, and it proved rather inferior to that variety for breadmaking.

Juliana. (White chaff, white grain). This was tested against Wilhelmina at four stations in 1934-35, and at six stations in the two following seasons. Fifteen trials were successfully harvested and in these Juliana gave yields significantly higher than the control on three occasions and significantly lower in two trials. In eleven trials its yield was equal to, or higher than, Wilhelmina and on an average of the fifteen trials its yield was 101.6 per cent. of that variety.

In a single trial at Askham Bryan in 1936 Juliana yielded 23 per cent. more than Squarehead's Master, and at Littleport in 1937 it yielded 16 per cent. more than Yeoman II; in both trials the differences were very significant.

Juliana ripens at the same time as Wilhelmina, and its straw, which is two or three inches shorter, resists lodging better. In most cases its grain has received a slightly higher market valuation than Wilhelmina and it appears to be of fair quality for breadmaking.

Juliana was tested *under high-farming conditions* at five stations in 1936 and 1937. The results, given in Tables XIII and XIV, show that in eight trials out of ten it gave significantly higher yields than Yeoman II; its average yield was thirteen per cent. higher than Yeoman II. In the high-farming trials it was at least as resistant to rust as Yeoman II, and it had straw of similar length, but rather more inclined to lodge. These trials are being continued, and the final results of yield and grain quality will be reported in due course.

Little Tich. (White chaff, red grain). Was tested against Yeoman II *in high-farming trials* at five centres in 1936 and at six centres in 1937. Except in one trial its yield was always below that of Yeoman II, and in four of the trials it was significantly lower. On an average of the eleven trials its yield was 91·0 per cent. of the control. In view of these consistent results the trials were not continued after 1937.

Little Tich ripens about the same date as Yeoman II—or sometimes a day or two earlier. Its straw is several inches shorter and is extremely resistant to lodging. Unfortunately it is susceptible to severe attacks of yellow rust and its disappointing yields in the high-farming trials were largely due to this fact. Its grain was invariably given a lower market value than Yeoman II. Its baking properties were fairly good but not equal to Yeoman II.

Little Joss. Two selections of Little Joss (Joss 3 and Joss 4) made at the Cambridge Plant Breeding Institute were tested against the Institute's stock of Little Joss in 1933 and 1934. The trials were at Sprowston where the soil conditions are particularly suitable for this variety. The field

behaviour of each selection was similar to that of the control and no significant yield differences were found.

Rivett wheat. Four selections of Rivett wheat Nos. 10, 11, 25 and 28, received from the Cambridge Plant Breeding Institute, were multiplied and put into field trials between 1933-1934 and 1936-1937. Except in 1934 all the trials were sown in randomized strips so that yield comparisons were possible between each selection as well as with the stock of Commercial Rivett used as control.

The average yields expressed as a percentage of the control were :—

No. 28	101·2	(5 trials)
No. 11	103·4	(5 ,,)
No. 10	106·7	(3 ,,)
No. 25	110·6	(5 ,,)

In 1936 and 1937 Percival's Blue Cone was included in three of the trials, but on an average its yield was only equal to 96 per cent. of Commercial Rivett.

Rivett No. 25 gave considerably higher yields than the other stocks, and, although it had slightly longer straw it stood better than the rest, being notably superior in this respect to either Percival's Blue Cone or Commercial Rivett. It is also very distinct from the others in the appearance of its young foliage, the leaf-blades being more erect, while at the ripening stage its drooping pale green ears turn to a pale brown colour. Although the market value of its grain does not differ materially from other Rivetts, it is clear that Rivett 25, on account of its superior yield, uniformity of growth and good straw, is well worth marketing, and this will be done in the near future.

SUMMARY OF CONCLUSIONS.

Of the white grained wheats dealt with in this report, although *Starling II* outyields Squarehead's Master it cannot be recommended when such varieties as Wilhelmina and Juliana are available. The same may be said of the new hybrid *162/55/1*. In respect of resistance to lodging, yield of grain and market valuation of the grain *Juliana* is slightly but definitely superior to Wilhelmina. In yield of grain and other agricultural features *Victor* may be considered as equal to Wilhelmina. The hybrid *162/8/1E* gave great promise as a high yielding variety, and appeared to be very suitable for high-farming conditions. Unfortunately its mixed grain colour prevents it from being placed on the market at present. Although *W.70E* produces grain of excellent breadmaking quality it was not worth marketing in view of its comparatively low yield.

Holdfast on the average yields slightly better than Yeoman and ripens earlier; its shorter straw is even more resistant to lodging. Baking tests show that its grain is definitely superior even to Yeoman for breadmaking, and it is much too strong for biscuits. Although Holdfast gives lower yields than Iron III the latter is much later in ripening and its grain is altogether inferior for breakmaking. Holdfast was first placed on the market by the Institute in the autumn of 1935.

Of the red grained varieties *Sun III* and *Brown's B.03561* appear to have no special merits to recommend them. *Gartons' 60* has similar qualities to Squarehead's Master, and while *Renown* has given higher yields its straw is liable to lodge. *Steel* gave rather variable yield results. On an average its yields were similar to Squarehead's Master under normal conditions of manuring. Under high-farming conditions its yields were scarcely as good as those of Iron III or Yeoman II. *Brown's 15/100* although yielding slightly more than Squarehead's Master was not considered to be worth marketing in view of the existence of heavier yielding red wheats of similar grain quality. *Redman* though giving similar yields to Yeoman II is rather inferior to it for breadmaking. *Little Tich* is extremely resistant to lodging but gives lower yields than Yeoman II where soil conditions favour heavy crops, and its grain is not equal to that variety in baking properties or market value.

Table I.

NORMAL WHEAT TRIALS, 1931-37.

Brief summary of soils, previous cropping, and manures applied to the wheat crops.

Season	Cambridge	Good Easter.	Cannington	Long Sutton.	Newport.	Sprowston.	Askham Bryan	Kirton.
1931-32	Medium loam. Cabbages. 1 cwt. Nitro-chalk.	Heavy clay. Trefoil and late fallows. 4 cwt. Super-phosphate. ¾ cwt. Nitrate of Soda.	Silty loam. Fallow. No manures.	Clay loam. Red clover. No manures.	Loamy sand. Potatoes. 1 cwt. Nitrate of Soda.			Deep loam. Peas. No manures.
1932-33	Heavy clay. Field peas. No manures.	Heavy clay. Clover. 2 cwt. Super-phosphate.	Light loam. Barley. 1 cwt. Sulphate of Ammonia.	A stony loam. Seeds hay. Artificials only.	Sandy loam. Mangolds. No manures.	Light loam. Seeds hay. No manures.		Deep loam. 1 cwt. Sulphate of Ammonia.
1933-34	Medium loam. Fallow. No manures.	Heavy clay. Beans. 2 cwt. Super-phosphate.	Silty loam. Oats. 1½ cwt. Sulphate of Ammonia.	Medium loam. Seeds hay. 1 cwt. Potash salts. 1 cwt. Sulphate of Ammonia.	Sandy loam. Potatoes. No manures.	Gravelly loam. Seeds hay. No manures.		Silt. Sugar beet. 3 cwt. Super-phosphate. 1½ cwt. Muriate of Potash.
1934-35	Gravelly loam. Field peas. 14 loads dung. 2 cwt. Super-phosphate. 1 cwt. Potash salts.		Silty loam. Seeds hay. 3 cwt. Super-phosphate. 1 cwt. Sulphate of Ammonia.	Heavy loam. Seeds hay. 1 cwt. Sulphate of Ammonia.	Sandy loam. Seeds hay. 10 loads dung.	Gravelly loam. Seeds hay. 8 loads dung.	Sandy loam. Seeds hay. No manures.	Silt. White mustard. No manures.
1935-36	Medium loam. Fallow. No manures.		Silty loam. Oats. 2 cwt. Super-phosphate 1 cwt. Potash salts. 1½ cwt. Sulphate of Ammonia.	Heavy loam. Red clover. 2 cwt. Super-phosphate. 1½ cwt. Potash salts. 1 cwt. Sulphate of Ammonia.	Loamy sand. Seeds. 10 loads dung.	Light loam. Seeds hay. 10 loads dung. 1 cwt. Nitro-chalk.	Sandy loam. Wheat. 12 loads dung.	
1936-37	Heavy clay. Peas. No manures. Rivett trials on gravelly loam after Buckwheat (ploughed in). 1½ cwt. Nitro-chalk.		Silty loam. Barley. 1½ cwt. Sulphate of Ammonia.	Heavy loam. Seeds hay. Complete artificials.	Loamy sand. Potatoes. No manures.	Light loam. Roots. 1 cwt. Sulphate of Ammonia.	Light loam. Spring Oats. 12 loads dung.	

Table II.

"HIGH FARMING" WHEAT TRIALS, 1932-36.

Brief summary of soils, previous cropping, and manures applied to the wheat crops.

Season	Cambridge	Good Easter.	Cannington.	Long Sutton.	Newport.	Sprowston.	Askham Bryan.	Kirton.
1932-33	Gravelly loam. Fallow. 4 cwt. Superphosphate 1 cwt. Potash salts. 1 cwt. Sulphate of Ammonia. 1 cwt. Nitro-chalk.	Heavy clay. Clover. 2 cwt. Superphosphate. 1½ cwt. Sulphate of Ammonia.	Light loam. Barley. 2 cwt. Superphosphate. 1 cwt. Potash salts. 1¾ cwt. Sulphate of Ammonia. 1 cwt. Nitro-chalk.	A stony loam. Seeds hay. 4 cwt. Superphosphate. 2 cwt. Potash salts. 2 cwt. Sulphate of Ammonia. 2 cwt. Nitro-chalk.	Sandy loam. Mangolds. 3 cwt. Superphosphate. 2 cwt. Potash salts. 1½ cwt. Sulphate of Ammonia.	Light loam. Seeds hay. 3 cwt. Superphosphate. 1 cwt. Muriate of Potash. 1⅓ cwt. Sulphate of Ammonia.		
1933-34		Heavy clay. Beans. 2 cwt. Superphosphate. 2 cwt. Sulphate of Ammonia.	Silty loam. Potatoes. 1½ cwt. Sulphate of Ammonia.		Sandy loam. Potatoes. 1½ cwt. Sulphate of Ammonia.	Light loam. Seeds hay. 2 cwt. Sulphate of Ammonia.		
1934-35	Gravelly loam. Field peas. 14 loads dung. 2 cwt. Superphosphate. 1 cwt. Potash salts. 2 cwt. Nitro-chalk.		Silty loam. Seeds. 3 cwt. Superphosphate. 1 cwt. Sulphate of Ammonia. 2 cwt. Nitro-chalk.	Heavy loam. Seeds hay. 1 cwt. Sulphate of Ammonia. 2 cwt. Nitro-chalk.	Sandy loam. Seeds hay. 10 loads dung. 2 cwt. Nitro-chalk.	Gravelly loam. Seeds hay. 8 loads dung. 2 cwt. Nitro-chalk.	Sandy loam. Seeds hay. 2 cwt. Nitro-chalk.	
1935-36	Medium loam. Fallow. 2 cwt. Nitro-chalk.		Silty loam. Barley. 3 cwt. Superphosphate. 1½ cwt. Potash salts. ¾ cwt. Sulphate of Ammonia. 2 cwt. Nitro-chalk.	Heavy loam. Red clover. 2 cwt. Superphosphate. 1½ cwt. Potash salts. 1 cwt. Sulphate of Ammonia. 2 cwt. Nitro-chalk.			Sandy loam. Wheat. 12 loads dung. 2 cwt. Nitro-chalk.	Rich silt. Brown mustard. 2 cwt. Nitro-chalk.
1936-37	Heavy clay. Peas 2 cwt. Nitro-chalk.		Silty loam. Barley. 1½ cwt. Sulphate of Ammonia. 1½ cwt. Nitro-chalk.	Heavy loam. Seeds hay. Artificials as in normal trials plus 12 loads dung and 2 cwt. Nitro-chalk.	Loamy sand. Seeds hay. 10 loads dung. 1 cwt. Sulphate of Ammonia. 2 cwt. Nitro-chalk.		Light loam. Spring oats. 12 loads dung. 2 cwt. Nitro-chalk.	**Littleport.** Deep Black Fen. Mangolds. No manures.

Table III.

YIELDS OF NORMAL WHEAT TRIALS, 1931-32.

Significant yield differences are printed in heavier type.

Station, and yield per acre of control variety, threshed weight	Name of variety	Yield as percentage of control, dry weight	Difference from control	Standard error, per cent.
CAMBRIDGE.				
Yeoman W.165D	Yeoman W.165D	100	—	—
Yield 19·8 cwt.	Holdfast	148	**+48**	2·45
GOOD EASTER.				
Yeoman W.165D	Yeoman W.165D	100	—	—
Yield 16·6 cwt.	Holdfast	112	**+12**	3·01
Iron III	Iron III	100	—	—
Yield 16·6 cwt.	Commercial Rivett	120	**+20**	3·58
Squarehead's Master	Squarehead's Master (a)	[100]	—	—
Average yield, 13·0 cwt	Iron III (a)	[119]	[**+19**]	4·66
	Steel (a)	[111]	[**+11**]	3·53
CANNINGTON.	Squarehead's Master	100	—	—
Squarehead's Master	Renown	115	**+15**	1·04
Average yield, 27·5 cwt.	Garton's No. 60	89	**−11**	0·98
	Brown's B.03561	108	**+ 8**	0·88
Wilhelmina	Wilhelmina	100	—	—
Yield, 27·2 cwt.	Victor	96	**− 4**	1·10
LONG SUTTON.	Squarehead's Master	100	—	—
Squarehead's Master	Steel	90	− 10	7·54
Average yield, 14·1 cwt.	Starling II	112	**+12**	5·79
Wilhelmina	Wilhelmina	100	—	—
Yield, 19·5 cwt.	Victor	94	− 6	6·03
NEWPORT.	Squarehead's Master	100	—	—
Squarehead's Master	Gartons' No. 60	93	**− 7**	1·81
Average yield, 20·2 cwt.	Brown's B.03561	114	**+14**	3·00
	Steel	121	**+21**	2·95
Squarehead's Master	Squarehead's Master (a)	[100]	—	—
Average yield, 20·0 cwt.	Iron III (a)	[100]	—	2·21
	Steel (a)	[117]	[**+17**]	1·19
KIRTON.				
Yeoman W.165D	Yeoman W.165D	100	—	—
Yield 18·0 cwt.	Holdfast	133	**+33**	2·30

(a) These results are given for record only, see p. 239. These trials received additional Nitrate of Soda at the rate of 1 cwt. per acre over the normal treatment shown in Table I.

Table IV.

YIELDS OF NORMAL WHEAT TRIALS, 1932-33.

Significant yield differences are printed in heavier type.

Station, and yield per acre of control variety, threshed weight	Name of variety	Yield as percentage of control, dry weight	Difference from control	Standard error per cent.
CAMBRIDGE.	Squarehead's Master	100	—	—
Squarehead's Master	Starling II	113	**+13**	4·29
Average yield, 22·4 cwt.	162/8/1E	115	**+15**	3·19
Yeoman W.165D	Yeoman W.165D	100	—	—
Average yield, 22·4 cwt.	Holdfast	96	– 4	3·40
	W.70E	100	—	4·35
GOOD EASTER.	Squarehead's Master	100	—	—
Squarehead's Master	162/8/1E	111	**+11**	1·23
Average yield, 28·2 cwt.	Sun III	101	+ 1	1·92
Yeoman W.165D	Yeoman W.165D	100	—	—
Average yield, 29·7 cwt.	Holdfast	102	+ 2	1·35
	W.70E ·	95	**– 5**	1·02
CANNINGTON.	Squarehead's Master	100	—	—
Squarehead's Master	162/8/1E	118	**+18**	3·70
Average yield, 15·3 cwt.	Garton's No. 60	99	– 1	2·57
Yeoman W.165D	Yeoman W.165D	100	—	—
Average yield, 12·7 cwt.	Holdfast	97	– 3	3·53
	W.70E	97	– 3	1·92
LONG SUTTON.	Squarehead's Master	100	—	—
Squarehead's Master	162/8/1E	101	+ 1	1·72
Average yield, 14·7 cwt.	Sun III	90	**10**	1·99
Yeoman W.165D	Yeoman W.165D	100	—	—
Average yield, 18·4 cwt.	Holdfast	94	**– 6**	2·44
	W.70E	87	**–13**	1·87
Wilhelmina	Wilhelmina	100	—	—
Yield, 16·5 cwt.	Victor	104	**+ 4**	0·97
NEWPORT.	Squarehead's Master	100	—	—
Squarehead's Master	162/8/1E	117	**+17**	1·50
Average yield, 27·2 cwt.	Sun III	103	+ 3	1·78
	Gartons' No. 60	104	**+ 4**	1·75
Yeoman W.165D	Yeoman W.165D	100	—	—
Average yield, 27·4 cwt.	Holdfast	97	– 3	2·91
	W.70E	89	**–11**	1·19
SPROWSTON.	Squarehead's Master	100	—	—
Squarehead's Master	Starling II	107	**+ 7**	2·26
Average yield, 24·9 cwt.	162/8/1E	100	—	1·47
Yeoman W.165D	Yeoman W.165D	100	—	—
Average yield, 23·6 cwt.	Holdfast	95	**– 5**	2·08
	W.70E	95	**– 5**	1·17
Little Joss (WN.8)	Little Joss (WN.8)	100	—	
Yield, 28·4 cwt.	Joss 3	103	+ 3	1·16
	Joss 4	100	—	
KIRTON.				
Yeoman W.165D	Yeoman W.165D	100	—	—
Yield, 23·9 cwt.	Holdfast	110	**+10**	2·85

Table V.

YIELDS OF NORMAL WHEAT TRIALS, 1933-34.

Significant yield differences are printed in heavier type.

Station, and yield per acre of control variety, threshed weight	Name of variety	Yield as percentage of control, dry weight	Difference from control	Standard error per cent.
CAMBRIDGE.	Squarehead's Master	100	—	—
Squarehead's Master	162/8/1E	106	**+ 6**	1·33
Average yield, 22·8 cwt.	162/55/1	88	**−12**	2·13
	Starling II	107	**+ 7**	1·37
GOOD EASTER.	Squarehead's Master	100	—	—
Squarehead's Master	162/8/1E	109	**+ 9**	2·18
Average yield, 29·5 cwt.	162/55/1	113	**+13**	2·46
Commercial Rivett	Commercial Rivett	100	—	—
Average yield, 34·5 cwt.	Rivett 11	106	**+ 6**	1·73
	Rivett 28	97	− 3	2·64
Yeoman W.165D	Yeoman W.165D	100	—	—
Yield, 29·3 cwt.	Holdfast	101	+ 1	2·17
CANNINGTON.	Squarehead's Master	100	—	—
Squarehead's Master	162/8/1E	130	**+30**	2·37
Average yield, 31·5 cwt.	162/55/1	124	**+24**	1·51
Yeoman W.165D	Yeoman W.165D	100	—	—
Yield, 34·1 cwt.	Holdfast	106	**+ 6**	1·86
LONG SUTTON.	Commercial Rivett	100	—	—
Commercial Rivett	Rivett 11	98	− 2	2·44
Average yield, 23·5 cwt.	Rivett 28	95	**− 5**	2·23
NEWPORT.	Squarehead's Master	100	—	—
Squarehead's Master	162/8/1E	124	**+24**	2·29
Average yield, 32·2 cwt.	162/55/1	114	**+14**	1·72
Yeoman W.165D	Yeoman W.165D	100	—	—
Yield, 38·4 cwt.	Holdfast	93	**− 7**	2·27
SPROWSTON.	Squarehead's Master	100	—	—
Squarehead's Master	162/8/1E	103	**+ 3**	1·16
Average yield, 19·9 cwt.	162/55/1	96	**− 4**	1·87
	Starling II	100	—	3·05
Yeoman W.165D	Yeoman W.165D	100	—	—
Yield, 14·8 cwt.	Holdfast	102	+ 2	2·37
Little Joss (WN.8)	Little Joss (WN.8)	100	—	
Yield, 23·5 cwt.	Little Joss (WN.9)	101	+ 1	
	Joss 3	101	+ 1	1·63
	Joss 4	99	− 1	
KIRTON.				
Yeoman W.165D	Yeoman W.165D	100	—	—
Yield, 31·6 cwt.	Holdfast	121	**+21**	4·27

Table VI.

YIELD OF NORMAL WHEAT TRIALS, 1934-35.

Significant yield differences are printed in heavier type.

Station, and yield per acre of control variety, threshed weight	Name of variety	Yield as percentage of control, dry weight	Difference from control	Standard error, per cent.
CAMBRIDGE.	Squarehead's Master	100	—	—
Squarehead's Master	162/8/1E	116	**+16**	3·04
Average yield, 23·5 cwt.	162/55/1	116	**+16**	1·86
Wilhelmina	Wilhelmina	100	—	—
Yield, 26·3 cwt.	Juliana	110	**+10**	1·84
Yeoman II,	Yeoman II	100	—	—
Yield, 27·3 cwt.	Redman	103	+ 3	2·60
Commercial Rivett	Commercial Rivett	100	—	
Yield, 30·6 cwt.	Rivett 10	104	+ 4	
	Rivett 11	101	+ 1	1·68
	Rivett 25	112	**+12**	
	Rivett 28	103	+ 3	
CANNINGTON.	Squarehead's Master	100	—	—
Squarehead's Master	162/8/1E	107	**+ 7**	1·17
Average yield, 27·4 cwt.	162/55/1	109	**+ 9**	1·28
	Brown's 15/100	103	**+ 3**	1·33
Wilhelmina	Wilhelmina	100	—	—
Yield, 29·6 cwt.	Juliana	102	+ 2	1·48
Yeoman II	Yeoman II	100	—	—
Yield, 25·5 cwt.	Redman	104	**+ 4**	0·82
LONG SUTTON.	Squarehead's Master	100	—	—
Squarehead's Master	162/8/1E	105	**+ 5**	1·95
Average yield, 20·5 cwt.	162/55/1	132	**+32**	1·89
NEWPORT.	Squarehead's Master	100	—	—
Squarehead's Master	162/8/1E	103	+ 3	2·82
Average yield, 26·2 cwt.	162/55/1	93	**− 7**	2·32
Wilhelmina	Wilhelmina	100	—	—
Yield, 25·7 cwt.	Juliana	95	**− 5**	0·70
Yeoman II	Yeoman II	100	—	—
Yield, 23·0 cwt.	Redman	94	**− 6**	2·05
SPROWSTON.	Squarehead's Master	100	—	—
Squarehead's Master	162/8/1E	101	+ 1	2·35
Average yield, 16·5 cwt.	162/55/1	107	**+ 7**	2·51
	Brown's 15/100	105	**+ 5**	1·46
Wilhelmina	Wilhelmina	100	—	—
Yield, 18·2 cwt.	Juliana	103	+ 3	3·36
Yeoman II	Yeoman II	100	—	—
Yield, 10·1 cwt.	Redman	106	+ 6	3·92
ASKHAM BRYAN.	Squarehead's Master	100	—	—
Squarehead's Master	162/8/1E	104	**+ 4**	1·47
Average yield, 22·9 cwt.	162/55/1	102	+ 2	1·77
	Brown's 15/100	105	+ 5	2·74
KIRTON.				
Yeoman II	Yeoman II	100	—	—
Yield, 37·5 cwt.	Holdfast	97	− 3	2·26

Table VII.

YIELDS OF NORMAL WHEAT TRIALS, 1935-36.

Significant yield differences are printed in heavier type.

Station, and yield per acre of control variety, threshed weight	Name of variety	Yield as percentage of control, dry weight	Difference from control	Standard error per cent.
CAMBRIDGE. Commercial Rivett, Yield, 26·0 cwt.	Commercial Rivett	100	—	*
	Rivett 10	105	+ 5	
	Rivett 11	103	+ 3	
	Rivett 25	101	+ 1	
	Rivett 28	102	+ 2	
CANNINGTON. Squarehead's Master Yield, 19·8 cwt.	Squarehead's Master	100	—	—
	Brown's 15/100	113	**+13**	0·89
Wilhelmina Yield, 24·2 cwt.	Wilhelmina	100	—	—
	Juliana	109	**+ 9**	0·93
Yeoman II Yield, 23·4 cwt.	Yeoman II	100	—	—
	Redman	105	**+ 5**	0·92
LONG SUTTON. Wilhelmina Yield, 19·9 cwt.	Wilhelmina	100	—	—
	Juliana	100	—	1·21
Yeoman II Yield, 16·9 cwt.	Yeoman II	100	—	—
	Redman	106	**+ 6**	1·45
NEWPORT. Wilhelmina Yield, 25·4 cwt.	Wilhelmina	100	—	—
	Juliana	98	− 2	2·67
Yeoman II Yield, 24·0 cwt.	Yeoman II	100	—	—
	Redman	88	**−12**	1·27
SPROWSTON. Squarehead's Master Yield, 19·2 cwt.	Squarehead's Master	100	—	—
	Brown's 15/100	101	+ 1	1·5
Wilhelmina Yield, 19·0 cwt.	Wilhelmina	100	—	—
	Juliana	107	**+ 7**	1·7
Yeoman II Yield, 18·0 cwt.	Yeoman II	100	—	—
	Redman	99	− 1	3·3
ASKHAM BRYAN. Squarehead's Master Average yield, 16·1 cwt.	Squarehead's Master	100	—	—
	Brown's 15/100	89	**−11**	3·36
	Juliana	123	**+23**	3·40
Wilhelmina Yield, 21·2 cwt.	Wilhelmina	100	—	—
	Juliana	92	− 8	5·12
Yeoman II Yield, 17·0 cwt.	Yeoman II	100	—	—
	Redman	95	− 5	8·44
ABBOTS RIPTON. Commercial Rivett Yield, 12·7 cwt.	Commercial Rivett	100	—	—
	Rivett 10	111	**+11**	2·38
	Rivett 11	109	**+ 9**	
	Rivett 25	126	**+26**	
	Rivett 28	109	**+ 9**	
	Percival's Blue Cone	109	**+ 9**	

* The value of Z was not significant at the 5% point and in consequence none of the differences was significant.

Table VIII.

YIELDS OF NORMAL WHEAT TRIALS, 1936-37.

Significant yield differences are printed in heavier type.

Station, and yield per acre of control variety, threshed weight	Name of variety	Yield as percentage of control, dry weight	Difference from control	Standard error per cent.
CAMBRIDGE.				
Juliana	Juliana	100	—	—
Yield, 20·8 cwt.	Robusta	87	**-13**	1·90
Commercial Rivett	Commercial Rivett	100	—	
Yield, 17·5 cwt.	Rivett 25	106	+ 6	3·54
	Percival's Blue Cone	83	**-17**	
CANNINGTON.				
Squarehead's Master	Squarehead's Master	100	—	—
Yield, 27·1 cwt.	Brown's 15/100	105	**+ 5**	1·04
Wilhelmina	Wilhelmina	100	—	—
Yield, 26·4 cwt.	Juliana	101	+ 1	1·95
Yeoman II	Yeoman II	100	—	—
Yield, 26·2 cwt.	Redman	104	**+ 4**	0·44
LONG SUTTON.				
Wilhelmina	Wilhelmina	100	—	—
Yield, 21·3 cwt.	Juliana	104	**+ 4**	1·48
Yeoman II	Yeoman II	100	—	—
Yield, 14·7 cwt.	Redman	105	+ 5	2·55
NEWPORT.				
Wilhelmina	Wilhelmina	100	—	—
Yield, 25·0 cwt.	Juliana	101	+ 1	1·87
Yeoman II	Yeoman II	100	—	—
Yield, 24 cwt.	Redman	90	**-10**	3·82
Juliana	Juliana	100	—	—
Yield, 28·8 cwt.	Robusta	85	**-15**	2·35
SPROWSTON.				
Squarehead's Master	Squarehead's Master	100	—	—
Yield, 19·8 cwt.	Brown's 15/100	114	**+14**	3·67
Wilhelmina	Wilhelmina	100	—	—
Yield, 23·3 cwt.	Juliana	92	**- 8**	3·00
Yeoman II	Yeoman II	100	—	—
Yield, 19·6 cwt.	Redman	111	**+11**	2·01
ASKHAM BRYAN.				
Squarehead's Master	Squarehead's Master	100	—	—
Yield, 22·2 cwt.	Brown's 15/100	97	- 3	2·40
Wilhelmina	Wilhelmina	100	—	—
Yield, 25·4 cwt.	Juliana	106	+ 6	3·92
Yeoman II	Yeoman II	100	—	—
Yield, 20·0 cwt.	Redman	103	+ 3	3·36
Juliana	Juliana	100	—	—
Yield, 25·6 cwt.	Chevalier	95	- 5	3·53
Juliana	Juliana	100	—	—
Yield, 25·2 cwt.	Crown	103	+ 3	4·94
MADINGLEY.				
Commercial Rivett	Commercial Rivett	100	—	
Yield, 15·8 cwt.	Rivett 25	108	**+ 8**	2·61
	Percival's Blue Cone	96	**- 4**	

Table IX.

TRIALS OF NEW VARIETIES OF WHEAT FROM THE CAMBRIDGE PLANT BREEDING INSTITUTE AND OF OTHER VARIETIES WITH YEOMAN II AS THE CONTROL, SEASONS 1936 AND 1937.

Significant yield differences are printed in heavier type.

Station, and yield per acre of control variety, threshed weight	Name of variety	Yield as percentage of control, dry weight	Difference from control	Standard error per cent.
CAMBRIDGE, 1936	Yeoman II	100	—	*
	Little Joss	96	− 4	
Yeoman II	Wilhelmina	103	+ 3	
Yield, 28·0 cwt.	P.B.I. 198 (20C)	103	+ 3	
	P.B.I. 201 (26C)	104	+ 4	
	P.B.I. 202 (31C)	99	− 1	
	P.B.I. 202 (47B)	106	+ 6	
	Juliana	105	+ 5	
	Redman	97	− 3	
LITTLEPORT, 1936.	Yeoman II	100	—	2·00
	Little Joss	103	+ 3	
Yeoman II	Wilhelmina	107	**+ 7**	
Yield, 27·4 cwt.	P.B.I. 198 (20C)	112	**+12**	
	P.B.I. 201 (26C)	103	+ 3	
	P.B.I. 202 (31C)	105	+ 5	
	P.B.I. 202 (47B)	101	+ 1	
LITTLEPORT, 1937.	Yeoman II	100	—	0·79
	Little Joss	98	− 2	
Yeoman II	Juliana	116	**+16**	
Yield, 34·1 cwt.	Squarehead II	104	**+ 4**	
	P.B.I. 198 (20C)	99	− 1	
	P.B.I. 202 (47B)	103	**+ 3**	

The Trial results at Cambridge in 1937 were unreliable owing to an attack of *Cercosporella*.

* The value of Z was not significant at the 5% point and in consequence none of the differences was significant.

Table X.

"HIGH FARMING" WHEAT TRIALS, 1932-33.

Significant yield differences are printed in heavier type.

Station, and yield per acre of control variety, threshed weight	Name of variety	Yield as percentage of control, dry weight	Difference from control	Standard error per cent.
CAMBRIDGE.	Iron III	100	—	
	Yeoman II	93	**- 7**	
Iron III	Holdfast	100	—	1·09
Yield, 38·9 cwt.	Steel	101	+ 1	
	162/8/1E	112	**+12**	
GOOD EASTER.	Iron III	100	—	
	Holdfast	100	—	
Iron III	Steel	108	+ 8	2·81
Yield, 35·3 cwt.	162/8/1E	111	**+11**	
	W.70E	100	—	
CANNINGTON.	Iron III	100	—	
	Holdfast	89	-11	
Iron III	Steel	96	- 4	4·70
Yield, 20·8 cwt.	162/8/1E	100	—	
	W.70E	100	—	
LONG SUTTON.	Iron III	100	—	
	Holdfast	79	**-21**	
Iron III	Steel	91	- 9	3·93
Yield, 20·6 cwt.	162/8/1E	105	+ 5	
	W.70E	81	**-19**	
NEWPORT.	Iron III	100	—	
	Holdfast	81	**19**	
Iron III	Steel	98	2	2·61
Yield, 29·0 cwt.	162/8/1E	112	**+12**	
	W.70E	84	**16**	
SPROWSTON.	Iron III	100	—	
	Holdfast	91	- 9	
Iron III	Steel	107	+ 7	2·93
Yield, 21·6 cwt.	162/8/1E	117	**+17**	
	W.70E	107	+ 7	

Table XI.

"HIGH FARMING" WHEAT TRIALS, 1933-34.

Significant yield differences are printed in heavier type.

Station, and yield per acre of control variety, threshed weight	Name of variety	Yield as percentage of control, dry weight	Difference from control	Standard error per cent.
GOOD EASTER.	Iron III	100	—	
	Holdfast	93	- 7	
Iron III	Steel	97	- 3	2·41
Yield, 38·8 cwt.	162/8/1E	99	- 1	
	162/55/1	90	**-10**	
CANNINGTON.	Iron III	100	—	
	Holdfast	73	**-27**	
Iron III	Steel	101	+ 1	3·28
Yield, 34·8 cwt.	162/8/1E	94	- 6	
	162/55/1	97	- 3	
NEWPORT.	Iron III	100	—	
	Holdfast	91	**- 9**	
Iron III	Steel	90	**-10**	1·58
Yield, 44·7 cwt.	162/8/1E	105	+ 5	
	162/55/1	92	**- 8**	
SPROWSTON.	Iron III	100	—	
	Holdfast	95	- 5	
Iron III	Steel	105	+ 5	2·97
Yield, 28·4 cwt.	162/8/1E	98	- 2	
	162/55/1	99	- 1	

The trials at Cambridge and Long Sutton failed in 1934.

Table XII.

"HIGH FARMING" WHEAT TRIALS, 1934-35.

Significant yield differences are printed in heavier type.

Station, and yield per acre of control variety, threshed weight	Name of variety	Yield as percentage of control, dry weight	Difference from control	Standard error per cent.
CAMBRIDGE.	Yeoman II	100	—	*
	Holdfast	99	- 1	
Yeoman II	Steel	96	- 4	
Yield, 28·1 cwt.	162/8/1E	91	- 9	
	162/55/1	106	+ 6	
CANNINGTON.	Yeoman II	100	—	*
	Holdfast	108	+ 8	
Yeoman II	Steel	100	—	
Yield, 30·0 cwt.	162/8/1E	107	+ 7	
	162/55/1	108	+ 8	
LONG SUTTON.	Yeoman II	100	—	2·55
	Holdfast	90	**-10**	
Yeoman II	Steel	80	**-20**	
Yield, 26·1 cwt.	162/8/1E	101	+ 1	
	162/55/1	103	+ 3	
NEWPORT.	Yeoman II	100	—	*
	Holdfast	96	- 4	
Yeoman II,	Steel	96	- 4	
Yield, 30·4 cwt.	162/8/1E	106	+ 6	
	162/55/1	106	+ 6	
SPROWSTON.	Yeoman II	100	—	*
	Holdfast	101	+ 1	
Yeoman II	Steel	115	+15	
Yield, 27·5 cwt.	162/8/1E	113	+13	
	162/55/1	113	+13	
ASKHAM BRYAN.	Yeoman II	100	—	*
	Holdfast	102	+ 2	
Yeoman II	Steel	89	-11	
Yield, 22·6 cwt.	162/8/1E	118	+18	
	162/55/1	94	- 6	

* The value of Z was not significant at the 5% point and in consequence none of the differences was significant.

Table XIII.

"HIGH FARMING" WHEAT TRIALS, 1935-36.

Significant yield differences are printed in heavier type.

Station, and yield per acre of control variety, threshed weight	Name of variety	Yield as percentage of control, dry weight	Difference from control	Standard error. per cent.
CAMBRIDGE.	Yeoman II	100	—	2·59
	Holdfast	95	− 5	
Yeoman II	Steel	109	**+ 9**	
Yield, 31·1 cwt.	162/55/1	109	**+ 9**	
	190/101	101	+ 1	
	Juliana	115	**+15**	
	Little Tich	92	− 8	
	Benoist 40	100	—	
CANNINGTON.	Yeoman II	100	—	1·68
	Holdfast	105	+ 5	
Yeoman II	Steel	104	+ 4	
Yield, 28·4 cwt.	162/55/1	118	**+18**	
	190/101	110	**+10**	
	Juliana	114	**+14**	
	Little Tich	99	− 1	
LONG SUTTON.	Yeoman II	100	—	1·90
	Holdfast	108	**+ 8**	
Yeoman II	Steel	97	− 3	
Yield, 19·9 cwt.	162/55/1	110	**+10**	
	190/101	111	**+11**	
	Juliana	113	**+13**	
	Little Tich	94	− 6	
	Benoist 40	84	**−16**	
ASKHAM BRYAN.	Yeoman II	100	—	*
	Holdfast	107	+ 7	
Yeoman II	Steel	98	− 2	
Yield, 19·3 cwt.	162/55/1	100	—	
	190/101	111	+11	
	Juliana	101	+ 1	
	Little Tich	106	+ 6	
KIRTON.	Yeoman II	100	—	2·43
	Holdfast	103	+ 3	
Yeoman II	162/55/1	110	**+10**	
Yield, 26·3 cwt.	190/101	109	**+ 9**	
	Juliana	118	**+18**	
	Little Tich	82	**−18**	
	Benoist 40	95	− 5	

* The value of Z was not significant at the 5% point and in consequence none of the differences was significant.

Table XIV.

"HIGH FARMING" WHEAT TRIALS, 1936-37.

Significant yield differences are printed in heavier type.

Station, and yield per acre of control variety, threshed weight	Name of variety	Yield as percentage of control, dry weight	Difference from control	Standard error per cent.
CAMBRIDGE.	Yeoman II	100	—	1·82
	190/101	97	- 3	
Yeoman II	Juliana	104	+ 4	
Yield, 30·2 cwt.	Little Tich	95	- 5	
	Desprez 80 (Joncquois)	115	**+15**	
CANNINGTON.	Yeoman II	100	—	2·47
	190/101	101	+ 1	
Yeoman II	Juliana (a)	—	—	
Yield, 29·9 cwt.	Little Tich	94	- 6	
	Desprez 80 (Joncquois)	120	**+20**	
LONG SUTTON.	Yeoman II	100	—	3·19
	190/101	102	+ 2	
Yeoman II	Juliana	122	**+22**	
Yield, 21·2 cwt.	Little Tich	64	**-36**	
	Desprez 80 (Joncquois)	122	**+22**	
NEWPORT.	Yeoman II	100	—	3·47
	190/101	129	**+29**	
Yeoman II	Juliana	124	**+24**	
Yield, 29·5 cwt.	Little Tich	93	- 7	
	Desprez 80 (Joncquois)	125	**+25**	
ASKHAM BRYAN.	Yeoman II	100	—	2·11
	190/101	97	- 3	
Yeoman II	Juliana	108	**+ 8**	
Yield, 28·9 cwt.	Little Tich	89	**-11**	
	Desprez 80 (Joncquois)	112	**+12**	
LITTLEPORT.	Yeoman II	100	—	0·72
	190/101	103	+ 3	
Yeoman II	Juliana	113	**+13**	
Yield, 34·4 cwt.	Little Tich	92	**- 8**	
	Desprez 80 (Joncquois) (b)	100	—	
	Holdfast	102	+ 2	

(a) The yield from this variety was not strictly comparable with the others owing to a harvesting error.
(b) The yield was seriously reduced by birds.

Table XV.

NORMAL WHEAT TRIALS, 1931-1937.

AVERAGE YIELDS OF WHEATS, TESTED AGAINST SQUAREHEAD'S MASTER AS CONTROL.

The figures in brackets indicate the number of trial results included in the average.

Variety.	Cambridge	Good Easter	Cannington	Long Sutton	Newport	Sprowston	Jealotts Hill	Askham Bryan	General average
	Per cent. of control	Per cent. of control	Per cent. of control	Per cent. of control	Per cent. of control	Per cent. of control	Per cent. of control	Per cent. of control	Per cent. of control
Squarehead's Master	100	100	100	100	100	100	100	—	100·0
Starling II	110·0 (2)	—	—	115·0 (3)		103·5 (2)	—	—	110·3 (7)
Sun III ...	—	101·0 (1)	—	90·0 (1)	103·0 (1)	—	—	—	98·0 (3)
Brown's B.03561	—	—	104·0 (2)	—	106·3 (3)	—	—	—	105·4 (5)
Renown ...	—	103·0 (1)	116·0 (2)	—	—	—	—	—	111·7 (3)
Gartons' 60 ...	—	—	94·0 (2)	—	98·5 (2)	—	—	—	96·2 (4)
Steel	—	—	113·0 (1)	100·3 (3)	98·7 (3)	93·0 (2)	107·0 (1)	—	100·3 (10)
162/8/1E	112·3 (3)	110·0 (2)	118·3 (3)	103·0 (2)	114·7 (3)	101·3 (3)	—	104·0 (1)	110·0 (17)
162/55/1	102·0 (2)	113·0 (1)	116·5 (2)	132·0 (1)	103·5 (2)	101·5 (2)	—	102·0 (1)	108·5 (11)
Brown's 15/100 ..	—	—	107·0 (3)	—	—	106·7 (3)	—	97·0 (3)	103·6 (9)
Average yield of control variety, Squarehead's Master, threshed weight, cwt. per acre	22·9	26·5	24·2	17·3	24·0	19·0	26·8	21·5	22·8

Table XVI.

AVERAGE YIELDS OF HOLDFAST, W.70E, VICTOR, JULIANA AND REDMAN WHEATS IN NORMAL TRIALS, SEASONS 1929-1937.

The yields are given as a percentage of the control varieties and the average threshed weight yield of the control is stated. The figures in brackets show the number of trial results included in the average.

Variety.	Cambridge	Good Easter	Cannington	Long Sutton	Newport	Sprowston	Kirton	General average
Holdfast ..	122·0 (2)	105·0 (3)	101·5 (2)	94·0 (1)	95·0 (2)	98·5 (2)	121·3 (3)	107·1 (15)
Yeoman W.165D (control) ...	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0
Average yield of control, cwt. per acre .	21·5	25·4	22·8	18·2	32·2	18·9	24·5	23·9
W.70E	100·0 (1)	95·0 (1)	97·0 (1)	87·0 (1)	89·0 (1)	95·0 (1)	—	93·8 (6)
Yeoman W.165D (control)	100·0	100·0	100·0	100·0	100·0	100·0	—	100·0
Average yield of control, cwt. per acre	21·6	29·2	13·8	18·5	28·8	24·2	—	22·7
Victor	97·1 (2)	—	96·0 (1)	99·0 (2)	—	—	—	97·6 (5)
Wilhelmina (control) .	100·0	—	100·0	100·0	—	—	—	100·0
Average yield of control, cwt. per acre	28·2	—	27·2	18·0	—	—	—	23·9
Juliana	106·0 (2)	—	104·0 (3)	102·0 (2)	98·0 (3)	100·7 (3)	(Askham Bryan) 99·0 (2)	101·6 (15)
Wilhelmina (control) .	100·0	—	100·0	100·0	100·0	100·0	100·0	100·0
Average yield of control, cwt. per acre .	27·4	—	26·7	20·6	25·4	20·2	23·3	23·9
Redman . .	100·0 (2)	—	104·3 (3)	105·5 (2)	90·7 (3)	105·3 (3)	(Askham Bryan) 99·0 (2)	100·8 (15)
Yeoman II (control) .	100·0	—	100·0	100·0	100·0	100·0	100·0	100·0
Average yield of control, cwt. per acre	27·6	—	25·0	15·8	23·7	15·9	18·5	21·1

Table XVII.

"HIGH FARMING" WHEAT TRIALS, 1932-1936.

AVERAGE YIELDS OF WHEATS OF WHICH TRIALS WERE COMPLETED IN 1936.

The yields are given as a percentage of the control varieties, and the average threshed weight yield of the control is stated. The figures in brackets indicate the number of trial results included in the average.

Variety.	Cambridge	Good Easter	Cannington	Long Sutton	Newport	Sprowston	Askham Bryan	Kirton	General average
Steel	101·0 (1)	102·5 (2)	98·5 (2)	91·0 (1)	94·0 (2)	106·0 (2)	—	—	99·4 (10)
Holdfast	100·0 (1)	96·5 (2)	81·0 (2)	79·0 (1)	86·0 (2)	93·0 (2)	—	—	89·2 (10)
162/8/1E	112·0 (1)	105·0 (2)	97·0 (2)	105·0 (1)	108·5 (2)	107·5 (2)	—	—	105·3 (10)
Iron III (control)	100·0	100·0	100·0	100·0	100·0	100·0	—	—	100·0
Average yield of control, cwt. per acre	38·9	37·0	27·8	20·6	36·9	25·0	—	—	31·3
Steel	102·5 (2)	—	102·0 (2)	88·5 (2)	96·0 (1)	115·0 (1)	93·5 (2)	—	98·4 (10)
Holdfast ..	97·0 (2)	—	106·5 (2)	99·0 (2)	96·0 (1)	101·0 (1)	104·5 (2)	103·0 (1)	101·3 (11)
162/55/1 . . .	107·5 (2)	—	113·0 (2)	106·5 (2)	106·0 (1)	113·0 (1)	97·0 (2)	110·0 (1)	107·0 (11)
Yeoman II (control)	100·0	—	100·0	100·0	100·0	100·0	100·0	100·0	100·0
Average yield of control, cwt. per acre ...	29·6	—	29·2	23·0	30·4	27·5	20·9	26·3	26·3
162/55/1	—	90·0 (1)	97·0 (1)	—	92·0 (1)	99·0 (1)	—	—	94·5 (4)
Iron III (control)	—	100·0	100·0	—	100·0	100·0	—	—	100·0
Yield of control, cwt. per acre	—	38·8	34·8	—	44·7	28·4	—	—	36·7
162/8/1E	91·0 (1)	—	107·0 (1)	101·0 (1)	106·0 (1)	113·0 (1)	118·0 (1)	—	106·0 (6)
Yeoman II (control)	100·0	—	100·0	100·0	100·0	100·0	100·0	—	100·0
Yield of control, cwt. per acre	28·1	—	30·0	26·1	30·4	27·5	22·6	—	27·4
W.70E	—	100·0 (1)	100·0 (1)	81·0 (1)	84·0 (1)	107·0 (1)	—	—	94·4 (5)
Iron III (control)	—	100·0	100·0	100·0	100·0	100·0	—	—	100·0
Yield of control, cwt. per acre	—	35·3	20·8	20·6	29·0	21·6	—	—	25·5

REPORT ON THE QUALITY—
FOR BREAD-MAKING PURPOSES—OF WHEATS
HARVESTED IN 1937

AT THE HEADQUARTERS AND SUB-STATIONS OF THE NATIONAL INSTITUTE OF AGRICULTURAL BOTANY.

As in 1936, at the request of the Home Grown Wheat Committee of the Incorporated National Association of British and Irish Millers, Ltd., this Report has been prepared by The Research Association of British Flour Millers.

The wheats examined were the following, each sample of 60 lb. being made up of equal quantities from the stations named :

From High-farming trials.		Cambridge, Cannington, Newport, Long Sutton and Askham Bryan (Yorks.) mixed.
1.	Yeoman II	Intensive manuring
2.	,, ,,	Normal ,,
3.	Juliana	Intensive ,,
4.	,,	Normal ,,
5.	190/101	Intensive ,,
6.	,,	Normal ,,
7.	Little Tich	Intensive ,,
8.	,, ,,	Normal ,,
9.	Desprez 80 (Joncquois)	Intensive ,,
10.	,, ,, ,,	Normal ,,
11.	Squarehead's Master	Intensive ,,
12.	,, ,,	Normal ,,
From Fen trials		Unmixed, from Littleport only.
13.	Holdfast.	
14.	Yeoman II.	
15.	198 (20C)	
16.	202 (47B)	
17.	Little Joss.	
From strip trials.		Cambridge, Cannington, Newport, Long Sutton and Askham Bryan mixed.
18.	Redman	
19.	Yeoman II	
From observation plots.		Cambridge, Long Sutton and Askham Bryan mixed.
20.	Ritchie's 55/10/2/C.	

APPEARANCE OF WHEATS.

None of the samples were uniform, that is, all consisted of mixtures of starchy and translucent grains. The starchy grains were invariably well filled with rounded cheeks but in many of the samples the translucent type varied from well-filled to thinner, more " troughy " grains with wide creases and angular cheeks.

Nos. 3, 4, 13 and 15 were " white " (i.e., pale yellow coloured) wheats, the rest were " red " (i.e., of a dull orange-brown colour). Since white wheats as a whole are considered to be " weaker " than red wheats, it is important to note that No. 13 had actually outstandingly good strength properties and was easily the best of the whole set in this respect. Nos. 9 and 10 again were coarse-looking, unattractive wheats, mixtures of dull brownish-yellow and pale yellow starchy and greyish yellow translucent grains, generally with crinkled skins; but in spite of their unprepossessing appearance, both had relatively very good strength properties ranking quite high in the series in this respect. Of the four specimens of Yeoman II, No. 14, which had very good general strength and came second in the series in order of strength, certainly had a slight preponderance of translucent over starchy grains while No. 19 with starchy grains decidedly in excess had poor baking qualities, no better than common non-Yeoman English. Nos. 1 and 2, finally, with about equal proportions of starchy and translucent grains were intermediate between Nos. 14 and 19 in strength.

It is evident therefore that outer appearance is of little value as an indication of baking properties, even in cases such as those now being discussed, of wheats grown in the same district and under similar climatic conditions.

As regards samples 1 to 12, intensive as against normal manuring has caused no great difference in the outer appearance of corresponding samples; No. 10 had more darkish red translucent grain than No. 9, and crinkled skins were less in evidence; while comparing Nos. 11 and 12, the latter had a rather more marked orange-yellow colour and contained more translucent grain of a longer, thinner shape.

The grains were in all cases of fair average size for English wheats, none of the samples showing any abnormality likely to cause trouble in commercial wheat cleaning, such as an undue proportion of grains large enough to be extracted with oats and barley or well matured grains small enough to be extracted with ordinary screenings.

General condition was very good, sprouted or weather damaged grain being practically absent.

WHEAT CLEANING, CONDITIONING AND MILLING.

All the samples were dry-cleaned on the laboratory wheat cleaning plant, which makes use of separation by sieves and of a scouring process, with aspiration both before and after scouring. The screenings were normal in amount and character for English wheat, ranging from 0·4 to 1·2% and consisting of small, shrivelled grain with grains split lengthwise in threshing, thin oats, chaff, scourer dust and small quantities of various common weed seeds.

The wheats varied in moisture content from 15·7 to 17·7% and were dried down before milling to figures ranging from 14·5 to 16·3% depending on the relative amounts of starchy and translucent grains in the samples. In general, the greater the amount of translucent grains in the samples the easier they milled, in spite of the fact that the wheats had been so conditioned that their moisture contents increased with the proportion of translucent grains. The majority in fact milled quite well, only Nos. 9, 10, 11, 12 and 17 giving soft reduction stocks which ground and dressed rather badly. It has already been mentioned that Nos. 9 and 10 were of unprepossessing appearance. The total flour extraction from No. 17 was definitely lower than from the rest, all of which gave good average length — 68·6 to 71·0%.

BAKING PROPERTIES.

All the flours were baked on two methods :

(1) The *multiple differential* method in general use in these laboratories (for details of which see the 1936 Report). This consisted of making three doughs with 2% yeast, 2% sugar (to ensure adequate gassing) and 1¼% salt, and fermenting at 80°F. for 2½, 3¼ and 4 hours in all respectively.

(2) Fermenting for six hours in all with ¾% yeast, 1¼% salt and 2% sugar at 80°F. This is one of the more drastic of the methods employed by the Home Grown Wheat Committee in earlier Reports.

The water absorption given was based on the figures indicated by the physical methods developed in these laboratories, and those figures gave satisfactory results when a small correction had been made for the varying degrees of stickiness shown by the doughs at the time of scaling : the water absorption figures given in the table are those thus corrected, with an additional correction for the varying moisture contents of the flours so that the figures for water absorption actually given refer to a 15% moisture content basis.

With each batch baked, two control flours were included, both London made, unbleached and untreated, one a 1/- Patent (referred to as Z), the other a standard grade (X).

The two baking methods used placed the flours in the same order both with reference to one another and to the two control flours used, and the results obtained enabled quite clear-cut conclusions to be drawn. The results obtained by method No. 1 were in a few cases so remarkable in fact as to suggest baking the flours by method No. 2 for confirmatory purposes. Further, method No. 2 is one which would also give information as to how the flours would suit the 8-hours fermentation process still used to some extent in the baking trade.

Holdfast (No. 13) gave outstandingly good results in all respects and was certainly the best of the whole set. In No. 1 baking method the dough worked quite similarly to reference flour X, which is rather the better of the two control flours, and gave an equally large, bold-looking loaf; No. 2 baking method proved to be rather more searching but the working properties of the dough were little inferior to those of Z and the bread also was closely similar. It has already been stated that Holdfast is a " white " wheat and that it is a practically universal view that the ordinary commercial varieties of white

English wheats have only moderate to poor strength — certainly considerably below that of the grists from which the commercial flours X and Z would be made. Yeoman II (No. 14) came next and as shown by both baking processes had the baking properties of a reasonably good bakers' flour.

Desprez 80 (No. 9) showed a further fall in strength. In baking method No. 2 it certainly gave bread equal in size to that from Z control flour, although in method No. 1 it hardly stood the same comparison so well : the crust however was considerably shorter and the crumb properties and the general working of the dough were distinctly worse than in the case of Z. Its general appearance would suggest that it had only the most mediocre strength properties.

Yeoman II (Nos. 1 and 2) although giving bread of good volume by method No. 1 was only moderate as judged by other bread properties and by the working of the doughs. The baker reported that both were " like weak Yeoman ".

Next follows a rather large group falling off gradually in general strength properties from something definitely below Nos. 1 and 2 to a level practically no higher than that of common non-Yeoman English types : the descending order in this group is — 10, 8, 7, 15, 3, 4, 6, 5. This placing is in each case a generalisation based on working properties of dough, volume and outer appearance of bread and crumb characters as shown by both baking methods.

There is finally another rather large group where these strength properties as a whole are little or no better than those of common non-Yeoman English types : the order is 18, 19, 16, 17, 20, 11, 12, but there was very little difference between them. Nos. 18 and 19 worked fairly well in method No. 1 when given only 2½ hours total fermentation but were " spent " at the scaling stage in method No. 2 and gave bread very poor in every aspect by both methods. The rest were quite similar in every way to Squarehead's Master, Nos. 11 and 12.

It is worth noting that the doughs from most of these flours are of a short rather than of an easily extensible character : only those mentioned as coming at the head of the list were noted by the baker as having good or fairly good extensibility and he applies the expression " claylike " to the great majority of the rest. This common dough property however was not accompanied by a corresponding similarity in crust and crumb characters, since in those cases where loaf-volume was poor, the crust varied from rounded with no break at one extreme to badly cracked with " flying " crust at the other; and crumb-texture varied from close and cheesy to coarse open honeycomb structure.

The best five of these flours are distinguished from the rest indeed in having much better " spring " in the doughs, the crumb being also more springy and of a more spongy character with more even and much finer grain.

As regards the first twelve of these wheats (i.e., Nos. 1 to 12) there is no evidence that intensive as compared with normal manuring makes any difference whatever to general baking properties : what slight differences there were between members of the respective pairs were not always in the same direction and in any case were too small to be significant. But Yeoman II, No. 14, grown in the Fen District had by far the best strength of the four

samples of this type, while the two grown under " high farming conditions " (Nos. 1 and 2) were as much superior to that grown as a strip-trial (No. 19) as they were inferior to No. 14. So that in these four cases cultural conditions may have had a predominating effect over variety in determining actual baking properties. It would be unsafe of course to base any generalisation on these specific observations.

ANALYTICAL AND OTHER DETERMINATIONS.

Bushel weight. The figures for the cleaned wheats — after screening and before conditioning — are mostly rather high in view of the somewhat high moisture contents. Nos. 9 and 10 in which many of the grains had crinkled skins which might be expected to reduce bushel weight have nevertheless quite high bushel weight.

Protein content: wheat. There is most certainly no general or close correlation between wheat protein content and general strength, so that any attempted assessment of baking properties on the basis of protein content is bound to be misleading. Thus No. 17 (Little Joss) with the highest protein content of all, is one of the weakest : Nos. 13, 14 and 15 come next in protein content, but whereas No. 13 is certainly the strongest of the whole set No. 15, with the same protein figure has only quite mediocre baking properties ; No. 14 with practically as high protein content comes second in the series as regards strength. Of the remainder the two highest in protein content, Nos. 16 and 11 have only quite poor baking properties — no better than the rest of this group — while Nos. 1 and 2 with lower protein figures have decidedly better strength.

Protein content: flour. The protein contents of the flours follow those of the corresponding wheats in a general way, but as is usual there is no constant relation between the two sets of figures.

Ash contents may be considered normal for straight-run flours from English wheats.

Maltose figures. These show no features of particular interest or abnormality, although as is generally found to be the case with samples milled in these laboratories the Yeoman wheats yield flours with relatively fairly high maltose figures; these figures are however exceeded by those from two of the other varieties — Little Tich (Nos. 7 and 8) and Ritchie's 55/10/2/C (No. 20).

Gas making capacity. All the flours, with the possible exception of Nos. 3 and 4, had quite sufficiently high gassing power and even the two exceptions were not particularly low in this factor.

COLOUR OF FLOUR.

The colours of these flours were measured by means of the Lovibond Tintometer, the possibility of using this well-known apparatus for flour colour measurement being a subject which has lately been under investigation in these laboratories.

It is desirable to be able to express this factor in figures in place of the usual vague verbal descriptions such as " dull rather pale cream ", which are of no value for scientific or commercial purposes.

The table on p. 12 gives the actual measurements recorded : in each case the colour of the flour is observed, first when the flattened flour-surface has been freshly wetted and later when the wet gloss has just dried off; the colour is always deeper at this later stage, and the deepening moreover is greater the more strongly coloured the flour, so that the second readings give a finer differentiation of colour.

The Tintometer indicates that the colour of well-milled commercial flours of standard or higher grade is a clear orange-yellow, expressible as mixtures of various proportions of red and yellow, with a preponderance of the latter, the amount of red increasing as the grade falls; grades lower than standard have a little blue in their composition as well, being therefore of a somewhat greyer hue.

In brief, these English wheat flours rank between " short patent " and " 1/- Patent " in terms of average commercially milled flours, as illustrated by the following figures.

		LOVIBOND UNITS.					
		" first wet " stage			" just dry " stage		
		red	yellow	blue	red	yellow	blue
Short Patent	(bleached)	0·41	1·16	0	0·63	1·70	0
2/- ,,	(unbleached)	0·46	1·37	0	0·71	2·15	0
1/- ,,	(light bleach)	0·53	1·24	0	0·86	1·90	0
No. 10		0·45	1·30	0	0·65	1·80	0
No. 3 and 4		0·45	1·45	0	0·65	2·40	0
No. 14		0·50	1·35	0	0·85	2·10	0
No. 11		0·45	1·45	0	0·80	2·70	0

No. 10, as an example, is similar to a rather highly bleached short patent and of a clear, pale cream colour, while No. 11 is of a much deeper yellow colour. The flours as a whole differ much more in yellowness than in the red factor, all being quite satisfactory in colour for laboratory milled straight run flours, with yields varying between 67·6 and 71%.

The strongest yellow colours are shown by Squarehead's Master (Nos. 11 and 12) and 198 (20C) No. 15; once again, cultural conditions had no effect whatever on flour colour.

There is incidentally no connection between ash content or skin colour, and flour colour in these wheats.

The different cultural conditions under which these wheats were grown have had some influence on the analytical figures; thus it may be not entirely chance that the five Fen-grown wheats, Nos. 13-17, have the highest protein contents of the whole series, although, as pointed out above, that circumstance has had no general beneficial influence on strength properties, even though these five wheats include the two strongest of the whole set. This general conclusion has been stated also in earlier reports of the Home Grown Wheat Committee.

Intensive as compared with normal manuring, again, has caused just a perceptible increase in the protein contents of the wheats, except in Desprez

80 (Nos. 9 and 10) where there is no difference; in all cases without exception intensive manuring has increased the protein content of the corresponding flours.

These varying cultural conditions have had no other general effect in any respect whatever—neither on ash content, flour colour, maltose figure, gassing properties or baking value of flours, nor on bushelweight or milling properties of wheats.

Comparison between 1935 and 1937 crop wheats.

Only three of these wheat varieties were grown in the two seasons under comparable conditions, viz., Yeoman II, Redman and Squarehead's Master. The following table shows properties as appear to be of interest :

	Wheat Protein 1935	Wheat Protein 1937	Flour Protein 1935	Flour Protein 1937	Maltose Figure 1935	Maltose Figure 1937	Baking properties. 1935	Baking properties. 1937
YEOMAN II.								
Intensive ..	9·6	9·3	8·9	8·1	1·5	1·9	good	fairly good
Normal ..	9·9	8·8	9·1	7·6	1·5	1·75	good	fairly good
Strip .	8·7	8·6	7·8	7·5	1·5	1·7	fairly good	poor/fair
Fen trials		11·9		10·2		2·05		v.g./exc.
SQUAREHEAD'S MASTER.								
Intensive	10·5	10·2	9·6	8·6	0·9	1·0	very poor	very poor
Normal .	10·3	9·4	9·4	8·0	0·8	1·0	do.	do.
Strip 14 .	8·8		7·4		0·7		do.	do.
,, 18	9·0		7·3		0·7		do.	do.
REDMAN.								
Strip .	9·0	9·0	7·6	7·8	1·05	1·65	good	poor/fair

Whereas in the 1937 crop wheats intensive manuring increased protein content, as compared with the results with normal manuring, it made no difference in the case of the 1935 crop wheats; on the whole the protein contents were much the same for the same variety in both years. Maltose figures tended to be a trifle higher in the flours from the 1937 crop wheats—significantly so in the cases of Yeoman II and Redman.

The Yeoman wheats of the 1937 crop vary considerably in baking properties according to their different cultural conditions, but as was found in the 1935 trials those grown under high farming conditions were definitely better than that grown in the normal strip trial.

Redman in the 1937 crop appears to have lost the Yeoman-like baking character shown by that grown in 1934-5, the later-grown sample having strength properties very little better than ordinary non-Yeoman English types.

Summary.

One of the wheats—Holdfast—grown in this series of trials had remarkably good strength for English wheat, giving flours equal in general baking properties to average London-made commercial bakers' flours. Holdfast is a

white wheat and it is a very general rule among the commercial grades of wheat *imported* into this country that white wheats are anything but strong.

This sample of Holdfast was grown in the Fens and it is interesting to note that the next strongest of the set, a sample of Yeoman II, was also grown in the Fens, a district not noted for the highest baking quality in its wheats.

Desprez 80 reared under intensive manurial conditions in the "high farming" set of trials had also very good general baking properties although it was of coarse-looking unattractive appearance.

Two further Yeoman II wheats, those grown in the high farming trials, were of good strength though not up to the standard of the three mentioned above, and indeed not up to the baking quality of typical good Yeoman.

The remaining samples showed a gradual fall in strength down to the level of ordinary common English varieties. The descending order of strength was :

Desprez 80 (normal manuring)	No. 10
Little Tich . ..	Nos. 8 and 7
198 (20C)	No. 15
Juliana . . .	Nos. 3 and 4
190/101	Nos. 6 and 5.

The last two were little better than common non-Yeoman English varieties and the remainder of the set were much the same; they were :

Redman	No. 18
Yeoman II	No. 19
202 (47B)	No. 16
Little Joss	No. 17
Ritchie's 58/10/2/C ..	No. 20
Squarehead's Master .	Nos. 11 and 12.

Intensive as compared with normal manuring had no effect on strength properties although slightly raising protein content, both in wheat and flour, in all cases. Another possible effect of cultural conditions may be seen in the fact that the Fen-grown wheats had the highest protein contents of the whole series; although two of these five wheats had excellent strength properties the remaining three were quite poor, so that relatively high protein content does not necessarily mean good baking properties even in wheats grown under similar climatic conditions. On the other hand, the four samples of Yeoman II show very marked differences in baking value, correlated with, though not necessarily caused by, variation in cultural conditions. The strength properties of certain varieties may be more sensitive to variations in such conditions so that a new variety need not necessarily be condemned as disappointing in strength when grown under one set of cultural conditions only.

Apart from protein content, other analytical factors were not affected by intensive as compared with normal manuring.

E. A. FISHER,
Director of Research.

January, 1938.

ANALYTICAL AND OTHER DATA.

No.	Variety.	WHEAT. Moisture content (dirty)	WHEAT. Bushel Wt. Dirty	WHEAT. Bushel Wt. Clean	WHEAT. Protein content	FLOUR. Protein content	FLOUR. Ash content	FLOUR. Maltose Fig.	FLOUR. Gassing P'pties	Colour-Lovibond Units. First wet Red	First wet Yellow	First wet Blue	Just dry Red	Just dry Yellow	Just dry Blue	BAKING PROPERTIES. Water absorption.	BAKING PROPERTIES. General	No.
	HIGH-FARMING TRIALS	%	lb/bus.		%	%	%									Gal/sk		
1	Yeoman II. intensive	16·8	63·2	64·5	9·32	8·13	0·45	1·9	high	0·50	1·30	0	0·80	2·20	0	15·0	good	1
2	„ „ normal	17·2	63·3	64·4	8·78	7·63	0·46	1·75	„	0·45	1·35	0	0·75	2·10	0	15·0	„	2
3	Juliana. intensive	16·4	63·2	64·6	8·87	7·56	0·47	1·05	r. low	0·45	1·45	0	0·65	2·40	0	14·5	fair	3
4	„ normal	16·7	63·6	64·4	8·55	7·31	0·44	1·0	„	0·45	1·45	0	0·65	2·40	0	14·2	„	4
5	190/101. intensive	16·0	62·8	63·4	9·46	8·46	0·52	1·6	r. high	0·50	1·35	0	0·75	2·05	0	15·0	poor	5
6	„ normal	17·4	61·9	62·5	9·21	8·06	0·52	1·7	„	0·45	1·30	0	0·70	2·10	0	15·0	r. poor	6
7	Little Tich intensive	16·6	62·3	63·7	9·47	8·25	0·52	2·1	high	0·45	1·35	0	0·80	2·10	0	15 1	f. good	7
8	„ „ normal	16·8	62·8	64·2	9·32	8·00	0·47	2·1	„	0·45	1·30	0	0·70	2·20	0	15·3	f. good	8
	Desprez 80 (Joncquois)																	
9	intensive	17·0	62·7	63·7	8·99	7·70	0·45	1·5	r. high	0·45	1·30	0	0·70	2·05	0	14·3	v. good	9
10	„ „ „ normal	17·3	62·5	63·5	9·03	7·56	0·46	1·35	„	0·45	1·30	0	0·65	1·80	0	13·5	f. good	10
	Squarehead's Master																	
11	intensive	16·6	63·7	64·5	10·16	8·64	0·45	1·0	mod.	0·45	1·45	0	0·80	2·70	0	14·0	poor	11
12	„ „ normal	16·4	63·7	64·5	9·44	8·01	0·43	1·0	„	0·45	1·50	0	0·75	2·55	0	14·3	„	12
	FEN TRIALS																	
13	Holdfast .. .	16·0	63·9	64·6	12·0	10·34	0·40	1·7	r. high	0·50	1·35	0	0·85	2·20	0	15·4	excellent	13
14	Yeoman II . .	17·4	61·2	62·0	11·9	10·16	0·43	1·7	„	0·50	1·35	0	0·85	2·10	0	15·1	v. gd/exc	14
15	198 (20C) . .	16·3	61·5	62·3	12·04	9·94	0·42	1·4	„	0·50	1·50	0	0·85	2·60	0·10	14·1	fair	15
16	202 (47B) . ..	15·7	61·3	62·4	10·63	8·64	0·44	1·2	„	0·50	1·35	0	0·65	2·25	0	14·0	poor	16
17	Little Joss	17·7	61·5	62·1	13·07	10·73	0·47	1·1	f. high	0·50	1·40	0	0·85	2·00	0·10	14·4	„	17
	STRIP TRIALS																	
18	Redman	16·4	62·6	64·0	8·98	7·81	0·45	1·65	r. high	0·40	1·45	0	0·65	2·15	0	14·4	poor	18
19	Yeoman II	16·0	63·4	64·6	8·59	7·53	0·50	2·05	„	0·45	1·40	0	0·65	2·15	0	15·2	„	19
	OBSERVATION PLOTS																	
20	Ritchie's 55/10/2/C	16·5	63·6	65·2	9·17	7·84	0·49	2·2	high	0·50	1·50	0	0·80	2·50	0	15·1	poor	20

SPRING BARLEY TRIALS, 1933 - 1937.

E. G. THOMPSON, M.A.

This report deals with trials of seven varieties from the point of view of their behaviour in the field. Their malting quality is discussed by Mr. Lancaster in a separate report on page 287. The method of trial used in 1933, 1934 and 1935 was the Beaven's half-drill strip system, but in 1936 and 1937 the trials were carried out on the randomized system. A randomized trial consisted of eight blocks, each block containing one strip of each of the varieties in the trial. Four of the varieties were of the Spratt-Archer type and for these Spratt-Archer was used as Control. One variety was similar to 1924 Plumage Archer and was tested against that variety, while the other two varieties were early maturing types and were tested for their suitability for late sowing against Victory.

The varieties tested were as follows :—

Golden Archer. The product of a cross between 1924 Plumage Archer and Spratt-Archer, made by Dr. E. S. Beaven. In general appearance it closely resembles the Spratt-Archer parent.

35/51S. A " pure line " of the same parentage and closely allied to Golden Archer.

35/7. A hybrid from the same cross as Golden Archer, but closely resembling the Plumage Archer parent. Placed on the market in 1935 as 1935 Plumage Archer.

New Cross. Introduced by Edward Webb & Sons (Stourbridge) Ltd. The product of a cross between Chevalier and Spratt-Archer.

Spratt-Archer 37 No. 3. An Irish selection from the original F2 plant No. 37 in the cross from which Dr. Hunter bred Spratt-Archer.

Kenia and *Maja.* Products of a cross between Binder and Gold made at Abed in Denmark.

The trials were carried out at the six stations of the Institute, including Good Easter, Essex, up to 1934. In 1935 this station was transferred to Askham Bryan, Yorkshire, but as Askham Bryan is not in the typical barley growing district of Yorkshire the Yorkshire barley trials were centred on the Wolds at Arras, near Market Weighton, on the farm of Mr. N. B. Stephenson. Particulars of the soils, manuring and previous cropping of these stations are given in Table I.

1933 Trials.

Golden Archer was the only variety tested in 1933, being in trials at all centres with Spratt-Archer as Control. Sowing took place between 11th and 31st March, except at Cambridge, where the trial was not sown until April 13th.

The crops were good at all centres except Cambridge, where late sowing after a kale crop, followed by dry conditions, caused rather poor growth and premature ripening. The summer was rather dry at most centres and harvest therefore fairly early, but as a consequence the crops stood well in spite of being heavy. There was fairly extensive lodging at Long Sutton and some patches at Cannington, but elsewhere there was very little actual lodging.

1934 Trials.

The trials of Golden Archer were continued and trials of New Cross and Beaven's 35/7 commenced; New Cross against Spratt-Archer and 35/7 against 1924 Plumage Archer. In addition trials of Kenia against Victory were arranged for sowing in the second half of April.

The drilling of the ordinary trials was done early. February was a dry month and all stations drilled between February 12th and 20th, except Newport, which drilled on March 6th. All the late sown trials were drilled between the 16th and 18th April. Owing to loose smut in the stocks of Kenia and Victory both these stocks had been treated with hot water.

The early sown trials made an excellent start but all the trials, and particularly the late sown ones, suffered considerably from drought in June and July. The yields were in many cases greatly affected and ripening was premature. At Cambridge charlock was troublesome and the early trials were sprayed with a mixture of Sulphuric Acid and Sulphate of Ammonia between May 10th - 12th. No serious lodging occurred anywhere, but the late sown Victory and Kenia suffered much more from mildew than the early trials, particularly at Long Sutton and Sprowston. There were also more weeds in the late sown trials than in the early sown trials.

1935 Trials.

The trials of Golden Archer were discontinued but trials of 35/51S, a similar variety, were commenced at all centres, and the Danish variety Maja was added to Kenia in the late sown trials.

All the drilling of the early trials was done between March 6th and March 27th but the late sown trials were not drilled until April 24th at the earliest station, and were not completed until May 4th.

The early growth was good but the season was again very dry and in most cases harvesting was unusually early. At Newport and Arras the conditions were considered very good but at the other centres the quality if not the yield was considered to have suffered from drought. No serious lodging occurred at any centre. The results of the trial of 35/7 at Sprowston are omitted owing to an error in harvesting.

1936 Trials.

The late sown trials were discontinued in 1936 and one new barley, Spratt-Archer 37 No. 3, was introduced into the trials sown at the normal period. The trials were carried out on the randomized system.

Owing to a wet period early in the year drilling did not commence until March 17th (Sprowston). The trials at Long Sutton and Newport were the last to be sown and were completed on April 7th. The season was wet and cold at first. Growth was slow but fairly satisfactory and ripening was more

normal than in the two previous years, but there was lodging at most centres and particularly at Long Sutton and Newport. There was one striking feature about the results in 1936, the consistently good showing of Spratt-Archer which, in comparison with the other varieties, did better than in the two previous years.

1937 Trials.

Three years' trials of New Cross and Beaven's 35/7 had been completed in 1936, and these varieties, together with 1924 Plumage Archer, the Control to 35/7, were not grown in 1937. At Cannington Spratt-Archer 37 No. 3 was not included, but instead both Kenia and Maja were placed in the trial against Spratt-Archer.

The 1937 season was abnormally wet in the early part of the year. As a consequence nearly all the trials were sown late, the earliest being Sprowston sown on the 24th March, and the latest Long Sutton sown on April 27th. None of the crops grew particularly well and, although the season commenced abnormally wet, effects of drought were felt on the lighter soils at Cannington and Sprowston by July. Moreover gout fly attacks were common and were noted as severe at Cambridge, Cannington and Long Sutton. Crops were light and the ripening was irregular, late tillers with green ears being found right up to the time of cutting. At Arras the crop was seriously troubled by weeds, particularly charlock, and in spite of spraying the position became so bad by the end of June that the trial had to be abandoned.

FIELD CHARACTERISTICS OF THE VARIETIES.

Tillering and early growth.

Golden Archer, 35/51S and New Cross were all very similar to Spratt-Archer in being free tillering and less erect in their early growth than Plumage Archer or 35/7. New Cross was fairly distinct from Spratt-Archer in having a lighter green colour but both Golden Archer and 35/51S were difficult to distinguish from Spratt-Archer in the field, except at critical stages like ear emergence. Beaven's 35/7 was closely similar in habit of growth to 1924 Plumage Archer. The early maturing barleys Kenia, Maja and Victory were generally erect in habit and did not tiller as freely in the late sown trials as did the barleys in the early sown trials.

Resistance to disease, etc.

The seed for the trials was dusted with a mercuric seed dressing and no serious attacks of leaf stripe, *Helminthosporium gramineum* were recorded, nor were there any other cases of serious disease. Mildew was however always more common on the late sown trials than on the earlier ones. In no case was any varietal difference noted with regard to resistance to disease. Pests, apart from the severe attack of gout fly in 1937, were chiefly confined to wireworm and birds. Birds are a constant source of trouble to small plots which are out of the ordinary time and the poor result of the Maja v. Spratt-Archer trial at Sprowston in 1936 was largely due to sparrow damage before harvest.

Time of maturity.

The differences in time of maturity were very small except in the case of the early types, Kenia, Maja and Victory. Golden Archer and 35/51S showed no significant difference from Spratt-Archer, while New Cross was on the average about one day later than Spratt-Archer. Spratt-Archer 37 No. 3 was slightly earlier than the Spratt-Archer control but the difference did not average one day. Beaven's 35/7 was considered slightly earlier than 1924 Plumage Archer. These two varieties were directly compared with Spratt-Archer only in 1936, but while there was support for the previous finding that Plumage Archer was earlier than Spratt-Archer, the difference never exceeded two days and on the average did not amount to one day.

Kenia and Maja were generally compared with Victory, and were alike in being two to three days later than that variety. Direct comparison between Kenia and Maja and Spratt-Archer was only possible on three occasions but these trials showed that Kenia and Maja were about seven days earlier than Spratt-Archer when sown at the same time.

Length and thickness of straw.

The straw of Beaven's 35/7 showed no difference in length from Plumage Archer in 1934 but in the following two years was slightly shorter, although the average difference was less than one inch. Both Plumage Archer and 35/7 had thicker straw than Spratt-Archer, and Plumage Archer was on the average two inches shorter than Spratt-Archer. Golden Archer, New Cross, 35/51S and Spratt-Archer 37 No. 3 showed no important differences from Spratt-Archer either in the length or thickness of the straw.

The length of straw in the late sown trials fluctuated considerably from station to station but was nearly always shorter than in the early sown trials. The difference in length between Kenia and Maja was small, Kenia being slightly the shorter. Both varieties averaged about 4 inches shorter straw than Victory, the length of which was about equal to that of Spratt-Archer when sown at the same time.

In table form the length of straw would be as follows :—

Spratt-Archer Spratt-Archer 37 No. 3 Golden Archer 35/51S New Cross Victory	all about the same length
1924 Plumage Archer	about 2 inches less
Beaven's 35/7	2 - 3 inches less
Maja Kenia	about 4 inches less

Resistance to lodging.

Lodging was severe only in 1936 but fortunately owing to the similarity of the varieties within their own groups it was easier to make a comparison between the varieties within these groups than is usual. On the other hand it was not possible to make comparison between the groups.

In the Spratt-Archer group there was little difference between the standing of Spratt-Archer and Golden Archer, but 35/51S, New Cross and Spratt-Archer 37 No. 3 did not stand so well as Spratt-Archer.

Beaven's 35/7 was similar to 1924 Plumage Archer in regard to standing power.

There was very little lodging in Maja and Kenia in any trial but both were definitely superior to Victory in resistance to lodging. As between Kenia and Maja, what little evidence there was suggested that Kenia was slightly more resistant that Maja.

CONSIDERATION OF THE VARIETIES

in the light of the report on their malting quality.

Golden Archer. This variety was not significantly better or worse than Spratt-Archer in the field. It was also similar to Spratt-Archer in malting value, but had a rather more pleasing appearance and was valued slightly higher.

New Cross and *35/51S.* Both these varieties were rather similar to Spratt-Archer in the field but their yield was no better and they did not resist lodging quite so well. In malting, they showed little difference from Spratt-Archer except that the nitrogen in New Cross was not so readily made soluble. On appearance New Cross was valued slightly below Spratt-Archer and 35/51S slightly above.

Spratt-Archer 37 No. 3. This barley is being tested a third year, but although slightly earlier than the ordinary Spratt-Archer, it did not yield significantly higher and did not stand quite so well.

Beaven's 35/7 (1935 Plumage Archer). This barley was a decided improvement on the Control, 1924 Plumage Archer. Its yield was better, it stood as well and ripened quite as early, giving grain fully equal in malting value. Further, the claim made for it that the ears did not break so readily in threshing as those of 1924 Plumage Archer, was confirmed. It should be used to replace 1924 Plumage Archer.

Kenia and *Maja.* Both these barleys had shorter straw and stood better than Victory. They were however definitely later maturing than Victory and with the late April sowing in the seasons in which they were tested the shortness of straw was no advantage and Victory did quite as well as either of them. It was the comment of several observers that Kenia responded well to favourable conditions but did not do well when conditions were at all unfavourable. There was definite evidence in 1935 that Maja was the heavier yielding barley of the two, although Kenia probably had the stronger straw.

There is insufficient evidence from these trials to say that Kenia and Maja are better yielding barleys than Spratt-Archer when sown early, although there is the suggestion that Maja would prove to be heavier yielding.

Both barleys are so distinct in grain characters from the ordinary English malting barleys that one would need to be assured that they would be acceptable to the English maltster before recommending their general cultivation.

Table I. SPRING BARLEY TRIALS, 1933-1937.
Summary of soils with height above sea level, manuring and previous cropping.
Weights all in cwt. per acre unless otherwise stated.

Season	Cambridge	Good Easter	Cannington	Long Sutton	Newport	Sprowston	Arras, near Market Weighton
1933	Gravelly loam 90 ft. 4 Super 2 30% Potash Salts ½ Nitro Chalk 1 S/A Kale	Heavy clay 190 ft. 4 Super 1 Nitrate of Soda Barley	Silty loam 25-30 ft. No manure Swedes and Kale	Clay loam 450 ft. No manure Mangolds	Loamy sand 223 ft. No manure Sugar beet	Gravelly loam 93 ft. No manure Sugar beet	
1934	Gravelly loam 80-90 ft. 10 loads muck Wheat	Heavy clay 190 ft. 4 Super 1 S/A Wheat	Silty loam 40-50 ft. No manure Roots	Med-heavy clay 460 ft. 2 Super 1½ 30% Potash Salts 1 S/A Wheat	Sand 230 ft. Tops sheeped Sugar beet	Free working loam 100 ft. Tops ploughed in Sugar beet	
1935	Heavy clay 80-90 ft. Tops ploughed in 3 Super 1 30% Potash Salts 1 S/A Roots		Silty loam 40 ft. No manure Barley	Med-heavy loam 490 ft. 1½ Super 1½ 30% Potash Salts 1 S/A Seeds once cut then folded	Sand 220 ft. Tops sheeped Sugar beet	Free working loam 100 ft. 3 Super 1 Muriate of Potash 1 S/A Wheat	Chalky loam 430 ft. No manure Turnips sheeped
1936	Gravelly loam 80-90 ft. 3 Super 1 30% Potash Salts 1 S/A Wheat.		Silty loam 50-60 ft. No manure Sugar beet	Med-heavy loam 420 ft. 10 loads dung 1½ Super 1 30% Potash Salts ½ S/A Wheat	Silty sand 211 ft. Tops sheeped Sugar beet	Free working loam 93 ft. 2 Super 1 Potash Salts 1 S/A Wheat	Chalky loam About 400 ft. No manure Swedes sheeped
1937	Medium-light loam 80-90 ft. 3 Super 1 30% Potash Salts ½ Nitro Chalk		Silty loam 50 ft. 3 Super 1 S/A	Med-heavy loam 485 ft. 1 Super 1 30% Potash Salts 1 S/A	Sand 220 ft. Tops sheeped	Free working loam 93 ft. 1¼ Super 1¼ 30% Potash Salts 2½ S/A	

Table II.

YIELD OF SPRING BARLEY, 1933.

Significant yield differences are printed in heavier type.

Station and yield per acre of control variety, threshed weight	Name of variety	Yield of grain as percentage of control, dry weight	Difference from control	Standard error of difference	Significant difference per cent.
CAMBRIDGE. Spratt-Archer 17·9 cwt.	Golden Archer	105	+5	4·08	9·1
GOOD EASTER. Spratt-Archer 27·9 cwt.	Golden Archer	101	+1	2·76	6·1
CANNINGTON. Spratt-Archer 32·7 cwt.	Golden Archer	94	**−6**	1·11	2·5
LONG SUTTON. Spratt-Archer 27·7 cwt.	Golden Archer	95	**−5**	2·15	4·8
NEWPORT. Spratt-Archer 23·8 cwt.	Golden Archer	93	**−7**	2·05	4·6
SPROWSTON. Spratt-Archer 22·0 cwt.	Golden Archer	102	+2	3·01	6·7

Table III.

YIELD OF SPRING BARLEY, 1934.

Significant differences are printed in heavier type.

Station and yield per acre of control variety, threshed weight	Name of variety	Yield of grain as percentage of control, dry weight	Difference from control	Standard error of difference per cent.	Significant difference per cent.
CAMBRIDGE. Spratt-Archer	Golden Archer	102	+ 2	5·47	12·2
Average 14·9 cwt.	New Cross	107	+ 7	3·69	8·2
Plumage Archer 13·9 cwt.	Beaven's 35/7	115	**+15**	2·49	5·5
Victory 14·0 cwt.	Kenia (late sown)	88	**−12**	3·31	7·4
GOOD EASTER. Spratt-Archer	Golden Archer	92	**− 8**	1·80	4·0
Average 22·8 cwt.	New Cross	96	**− 4**	1·21	2·7
Plumage Archer 23·9 cwt.	Beaven's 35/7	99	− 1	1·38	3·1
Victory 21·7 cwt.	Kenia (late sown)	104	**+ 4**	1·32	2·9
CANNINGTON. Spratt-Archer	Golden Archer	95	**− 5**	0·98	2·2
Average 34·0 cwt.	New Cross	97	− 3	1·48	3·3
Plumage Archer 29 cwt.	Beaven's 35/7	108	**+ 8**	1·66	3·7
Victory 23·0 cwt.	Kenia (late sown)	98	− 2	2·53	5·6
LONG SUTTON. Spratt-Archer	Golden Archer	100	—	1·51	3·4
Average 23·8 cwt.	New Cross	102	+ 2	1·54	3·4
Plumage Archer 22·8 cwt.	Beaven's 35/7	98	− 2	2·03	4·5
Victory 12·4 cwt.	Kenia (late sown)	117	**+17**	4·89	10·9
NEWPORT. Spratt-Archer	Golden Archer	97	− 3	1·96	4·4
Average 13.6 cwt.	New Cross	105	+ 5	4·11	9·2
Plumage Archer 14·5 cwt.	Beaven's 35/7	106	**+ 6**	2·21	4·9
Victory 18·0 cwt.	Kenia (late sown)	85	**−15**	3·81	8·5
SPROWSTON. Spratt-Archer	Golden Archer	105	+ 5	2·94	6·6
Average 22·1 cwt.	New Cross	104	+ 4	1·97	4·4
Plumage Archer 22·5 cwt.	Beaven's 35/7	103	+ 3	5·22	11·6
Victory 18·7 cwt.	Kenia (late sown)	118	**+18**	2·51	5·6

Table IV.

YIELD OF SPRING BARLEY, 1935.

Significant yield differences are printed in heavier type.

Station and yield per acre of control variety, threshed weight	Name of variety	Yield of grain as percentage of control, dry weight	Difference from control	Standard error of difference per cent.	Significant difference per cent.
CAMBRIDGE.					
Spratt-Archer	New Cross	100	—	1·50	3·3
Average 27·2 cwt.	35/51S	110	**+10**	1·62	3·6
Plumage Archer					
27·3 cwt.	Beaven's 35/7	107	**+ 7**	1·71	3·8
Victory	Kenia (late sown)	86	**−14**	2·31	5·1
Average 24·4 cwt.	Maja (late sown)	92	**− 8**	1·57	3·5
CANNINGTON.					
Spratt-Archer	New Cross	94	− 6	3·13	7·0
Average 29·3 cwt.	35/51S	99	− 1	2·65	5·9
Plumage Archer					
26·9 cwt.	Beaven's 35/7	108	**+ 8**	1·33	3·0
Victory	Kenia (late sown)	94	− 6	4·04	9·3
Average 27·9 cwt.	Maja (late sown)	99	− 1	2·02	4·7
LONG SUTTON.					
Spratt-Archer	New Cross	98	− 2	1·31	2·9
Average 19·8 cwt.	35/51S	102	+ 2	1·94	4·3
Plumage Archer					
19·4 cwt.	Beaven's 35/7	106	**+ 6**	0·92	2·0
Victory	Kenia (late sown)	89	**−11**	2·41	5·4
Average 18·9 cwt.	Maja (late sown)	91	**− 9**	1·16	2·6
NEWPORT.					
Spratt-Archer	New Cross	96	**− 4**	1·06	2·4
Average 30·4 cwt.	35/51S	104	**+ 4**	1·37	3·0
Plumage Archer					
21·4 cwt.	Beaven's 35/7	113	**+13**	2·06	4·6
Victory	Kenia (late sown)	98	− 2	3·22	7·2
Average 32·8 cwt.	Maja (late sown)	102	+ 2	1·59	3·5
SPROWSTON.					
Spratt-Archer	New Cross	104	**+ 4**	1·19	2·7
Average 17·5 cwt.	35/51S	106	**+ 6**	1·53	3·4
	Maja	110	**+10**	2·57	5·7
Victory	Kenia (late sown)	106	**+ 6**	1·85	4·1
Average 18·0 cwt.	Maja (late sown)	107	**+ 7**	2·02	4·5
ARRAS, near MARKET WEIGHTON					
Spratt-Archer	New Cross	97	− 3	1·38	3·1
Average 25·9 cwt.	35/51S	98	− 2	2·24	5·0
Plumage Archer	Beaven's 35/7	103	**+ 3**	1·28	2·9
Average 20·9 cwt.					
Victory	Kenia (late sown)	99	− 1	5·78	12·9
Average 17·2 cwt.	Maja (late sown)	115	+15	6·75	15·6

Table V.

YIELD OF SPRING BARLEY, 1936.

Significant yield differences are printed in heavier type.

Station and yield per acre of control variety, threshed weight	Name of variety	Yield of grain as percentage of control, dry weight	Difference from control	Standard error of difference per cent.	Significant difference per cent.
CAMBRIDGE.					
Spratt-Archer	New Cross	91	**− 9**	1·12	3·7
26·4 cwt.	35/51S	97	− 3		
	Plumage Archer	84	**−16**		
	Beaven's 35/7	94 (112)	**− 6**		
	Spratt-Archer 37 No. 3	102	+ 2		
CANNINGTON.					
Spratt-Archer	New Cross	102	+ 2	2·15	7·0
22·9 cwt.	35/51S	94	− 6		
	Plumage Archer	83	**−17**		
	Beaven's 35/7	98 (118)	− 2		
	Spratt-Archer 37 No. 3	103	+ 3		
LONG SUTTON.					
Spratt-Archer	New Cross	85	**−15**	2·14	7·0
22·5 cwt.	35/51S	81	**−19**		
	Plumage Archer	92	**− 8**		
	Beaven's 35/7	90 (98)	**−10**		
	Spratt-Archer 37 No. 3	100	—		
NEWPORT.					
Spratt-Archer	New Cross	94	**− 6**	1·69	5·9
27·5 cwt.	35/51S	94	**− 6**		
	Plumage Archer	96	− 4		
	Beaven's 35/7	101 (105)	+ 1		
	Spratt-Archer 37 No. 3	95	− 5		
SPROWSTON.					
Spratt-Archer 21·1 cwt.	New Cross	95	− 5	1·85	6·4
	35/51S	96	− 4		
	Plumage Archer	90	**−10**		
	Beaven's 35/7	94 (104)	− 6		
Spratt-Archer 24·4 cwt.	Spratt-Archer 37 No. 3	96	− 4		
	Maja	89	−11	6·28	14·0
ARRAS, near MARKET WEIGHTON					
Spratt-Archer	New Cross	98	− 2	3·16	10·3
20·2 cwt.	35/51S	96	− 4		
	Plumage Archer	103	+ 3		
	Beaven's 35/7	103 (100)	+ 3		
	Spratt-Archer 37 No. 3	100	—		

The figures in brackets in the yield of grain column give the yield of Beaven's 35/7 calculated as a percentage of Plumage Archer.

Table VI.

YIELD OF SPRING BARLEY, 1937.

Significant yield differences are printed in heavier type.

Station and yield per acre of control variety, threshed weight	Name of variety	Yield of grain as percentage of control, dry weight	Difference from control	Standard error per cent.	Significant difference per cent.
CAMBRIDGE.					
Spratt-Archer	35/51S	93	**− 7**	2·12	6·9
17·8 cwt.	Spratt-Archer 37 No. 3	97	− 3		
CANNINGTON.					
Spratt-Archer	35/51S	91	**− 9**	1·85	6·0
19·9 cwt.	Kenia	95	− 5		
	Maja	105	+ 5		
LONG SUTTON.					
Spratt-Archer.	35/51S	96	− 4	1·61	5·3
17·6 cwt.	Spratt-Archer 37 No. 3	104	+ 4		
NEWPORT.					
Spratt-Archer	35/51S	94	− 6	2·89	9·4
21·3 cwt.	Spratt-Archer 37 No. 3	103	+ 3		
SPROWSTON.					
Spratt-Archer.	35/51S	97	− 3	1·78	5·8
20·6 cwt.	Spratt-Archer 37 No. 3	103	+ 3		

Table VII.

AVERAGE YIELD OF GRAIN OF SPRING BARLEYS, 1933-1937.

The figures in brackets indicate the number of trial results included in the average.

	Cambridge	Good Easter	Cannington	Long Sutton	Newport	Sprowston	Market Weighton	General average
Spratt-Archer (control) .	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0
Golden Archer	103·5 (2)	96·5 (2)	94·5 (2)	97·5 (2)	95·0 (2)	103·5 (2)	—	98·4 (12)
New Cross ...	99·3 (3)	96·0 (1)	97·7 (3)	95·0 (3)	98·3 (3)	101·0 (3)	97·5 (2)	98·1 (18)
35/51S	100·0 (3)	—	94·7 (3)	93·0 (3)	97·3 (3)	99·7 (3)	97·0 (2)	96·9 (17)
Spratt-Archer 37 No. 3 .	99·5 (2)	—	103·0 (1)	102·0 (2)	99·0 (2)	99·5 (2)	100·0 (1)	100·3 (10)
1924 Plumage Archer ...	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0
35/7 (1935 Plumage Archer) .. .	111·3 (3)	99·0 (1)	111·3 (3)	100·7 (3)	108·0 (3)	103·5 (2)	101·5 (2)	106·0 (17)
Victory (late sown) ...	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0
Kenia (late sown) ..	87·0 (2)	104·0 (1)	96·0 (2)	103·0 (2)	91·5 (2)	112·0 (2)	99·0 (1)	98·5 (12)
Maja (late sown) ...	92·0 (1)	—	99·0 (1)	91·0 (1)	102·0 (1)	107·0 (1)	115·0 (1)	101·0 6

MALTING QUALITY OF SPRING BARLEYS, 1933 - 1936.

By H. M. LANCASTER.

In attempting to estimate the malting-value of any barley, one is faced by several difficulties, which, though perhaps not very obvious to the brewer who has formed a definite opinion of the qualities necessary in the malts for use in any one brewery, or group of breweries, or to the maltster who knows the requirements of his several clients, have, perforce been brought to the attention of those who have been studying the question of barley-values and malt-values for many years.

The first of these is the question of market-value.

Quite apart from the violent fluctuations in the value of all cereals which has been such a feature of the post-war years, and the tendency of certain buyers to pay " fancy " prices for physical appearance, one finds differences of opinion among brewers which lead to substantial differences in their estimate of the value of any particular sample.

To take a case in point. Spratt-Archer barley, or to include a rather wider range, those hybrids which produce the narrower-eared barleys, produce corns more spherical in shape than those which come from the wider-eared varieties, and a good many buyers are willing to pay more for these than for the more spindle-shaped grain derived from Plumage Archer and kindred sorts. But there are others who hold opposite views, so that we commence by being faced with the anomaly that, on the same day, on the same market, one buyer will be willing to pay more for the produce of a narrow-eared barley than for that of a wide-eared barley, and vice-versa.

Again, buyers have to get used to a new type. When Messrs. Webb's New Cross barley first appeared on the markets its appearance made many buyers avoid it, owing to a rather grey colour and " loose " skin. The year or two's experience we have had of its malting quality seems to go to show that their judgment was rather premature, at any rate as to the brewing value of the malts made from it.

So, in assessing the malting-value of any barley, too much importance should not be paid to " market-value ", although this factor is necessarily one of the most important points for the grower. A difference in " market-value " of two or three shillings a quarter, which may easily be neutralized by yield per acre, does not necessarily mean very much, as in these cases that difference may often be due to the preference of one buyer. When the difference is in the neighbourhood of 10/- per quarter it may be surmised with tolerable safety that the difference in appearance is such that the buyer con-

siders that the barley will not make malt sufficiently attractive in appearance to tempt the brewer to buy. For many brewers still attach much importance to the appearance of the malt they use, which, as a rule, reflects the appearance of the barley from which it was made.

It must be remembered that different breweries buy different types of malt: some are greatly influenced by appearance, while also demanding analyses conforming to their ideas of composition. Others disregard appearance and buy entirely on analysis.

The figures which are probably of the greatest importance in malt-analyses are Brewer's extract, which, other things being equal, determines the commercial value of the malt, and the amount of permanently soluble nitrogen present after malting. With regard to extract, there can be no two opinions. With regard to the permanently soluble nitrogen. opinion is divided. Some brewers consider that the value of any malt depends mainly upon the amount of barley-nitrogen rendered soluble during the malting process. The more the better. With our native barleys the rule seems to be that the lower the original nitrogen content of the barley the higher that figure will be. That is, while in the case of a barley of 1·0 of nitrogen, 50% may be rendered soluble during the malting process, in the case of a barley with 2% of nitrogen, it would be exceptional for the maltster to get 30% permanently soluble. Those brewers who require high percentages of permanently soluble nitrogen in their malts seem to be of the opinion that the degradation of the proteid matter of barley during the malting process should be carried as far as possible. But others hold a diametrically opposite view and require their malts to be as low as possible in content of permanently soluble nitrogen, consistent with adequate break-down of carbo-hydrate matter.

Barleys vary in their reaction to the malting process in this respect. Among our native barleys, the wide-eared varieties generally seem to give a higher percentage of permanently soluble nitrogen to total nitrogen than the narrower-eared sorts.

Turning to the four years under consideration.

In 1933, Golden Archer was slightly superior in appearance as barley, and made very slightly better malt than the Spratt-Archer which was grown as a control.

In 1934, in the test of the two wide-eared barleys, 35/7 and Plumage Archer, these came out practically level in every respect affecting the maltster and brewer. They were very slightly better than the two narrower-eared hybrids, Golden Archer and Spratt-Archer, which also came out very level. All these four barleys were valued substantially above the Spratt-Archer which served as a control for New Cross, and which as barley was valued slightly above it. It should be noted, however, that in the case of the malts made from these six tests there was practically no difference in analytical value, except that the malt from New Cross showed a distinctly lower percentage of soluble nitrogen than the others. In the case of the Kenia Victory trials, the Kenia came out slightly better, but both barleys produced rather poor malts.

These 1934 trials were illustrative of the dangers inherent in the market valuation of barleys when the relative value of the malts they produce is considered.

In barley-valuation the order was as follows :—

35/7	44/-
Plumage Archer ...	43/10
Golden Archer ...	42/2
Spratt-Archer ...	41/2
Spratt-Archer ...	35/1
New Cross	33/8
Kenia	31/8
Victory	31/-

But in malt values, judged by analysis, there was practically no difference between the first six malts, though the last two were distinctly inferior, and would probably have been rejected by many brewers. This seems to suggest that in the case of 35/7 and New Cross a difference of over 10/- per quarter in barley valuation simply meant that one barley made a malt of rather more pleasant appearance than the other, though the brewing-value of the two was identical. But in the case of New Cross and Victory the difference of 2/8 in market value of the barleys was far too small when the respective values of the malts made from them was considered.

In this context it must not be forgotten that, while the first six barleys contained low or low-medium amounts of nitrogen, the two last contained 1·88% and 1·83% respectively.

In the 1935 trials New Cross was valued at 3/- less than its Spratt-Archer control, and the malts were of almost exactly the same value : 35/51S and its Spratt-Archer control were equal in malt-value, but the former was a slightly better looking barley, and made rather pleasanter looking malt : 35/7 and Plumage Archer were practically identical in both barley and malt value : Maja was tested against Spratt-Archer at Sprowston only. In appearance Spratt-Archer was slightly superior, though there was little difference in malt-value.

In 1936, the values ascribed to the barleys were as follows :—

Spratt-Archer ...	42/-
35/7	42/-
35/51S	42/-
Plumage Archer ...	39/-
37 No. 3	39/-
New Cross	36/-

There was no appreciable difference in the malts, except that, as usual, New Cross was lower in the amount of nitrogen made soluble during malting. Maja was tested against Spratt-Archer at Sprowston only. The Spratt-Archer was valued at 52/- against 38/- for the Maja. There was, however, practically no difference in the value of the malts made from the two barleys.

From the malting, as opposed to the agricultural standpoint, it is difficult to find much difference in actual value between the original (1924) Plumage Archer, Spratt-Archer, Golden Archer, 35/7 (now in cultivation as " Plumage Archer 1935 "), 35/51S (which is closely akin to Golden Archer), New Cross and Spratt-Archer 37 No. 3 (an Irish-bred barley of great promise), except in the reaction of the proteid matter to the malting process.

In appearance, however, Golden Archer and 35/51S are rather more pleasing to the eye, both as barley and malt, and New Cross and Spratt-Archer 37 No. 3 slightly less good-looking.

Both Kenia and Maja seem to require further tests before their brewing value can be determined.

Table I.

QUALITY OF BARLEY AND OF MALT

Average of all stations.

1933 and 1934 Trials.

Name of variety	BARLEY			MALT			
	1000 corn weight grams dry	Percentage of nitrogen dry	Valuation shillings per 448 lb.	Extract brewers' lb. per 336 lb. dry malt	Permanently soluble nitrogen percentage dry	Valuation shillings per 336 lb.	P.S.N. of dry malt as percentage of total nitrogen of dry barley
1933.							
Golden Archer ...	39·7	1·42	42	101·1	0·51	58	35·9
Spratt-Archer ...	37·8	1·42	41	100·6	0·52	57	36·6
1934.							
Beaven's 35/7 ...	39·9	1·42	44	100·4	0·52	60	36·7
Plumage Archer 1924	39·1	1·42	44	100·7	0·51	60	36·0
Golden Archer ...	38·1	1·44	42	100·3	0·51	58	35·2
Spratt-Archer ...	36·6	1·47	41	99·7	0·51	57	34·7
New Cross ...	34·8	1·49	34	100·2	0·50	50	33·8
Spratt-Archer ...	35·7	1·45	35	100·2	0·51	51	35·1
Kenia ...	35·5	1·88	32	96·2	0·54	48	28·6
Victory ...	38·3	1·83	31	95·0	0·47	47	25·5

Table II.

QUALITY OF BARLEY AND OF MALT.

Average of all stations.

1935 and 1936 Trials.

Name of variety	BARLEY			MALT		
	1000 corn weight grams dry	Percentage of nitrogen dry	Valuation shillings per 448 lb.	Extract brewers' lb. per 336 lb. dry malt	Permanently soluble nitrogen percentage dry	P.S.N. of dry malt as percentage of total nitrogen of dry barley
1935.						
35/7	37·5	1·42	32·8	100·5	0·47	33·1
Plumage Archer 1924	37·8	1·48	32·9	100·6	0·51	34·5
New Cross	32·7	1·48	26·8	100·4	0·48	32·4
Spratt-Archer ...	33·3	1·41	30·3	100·2	0·47	33·3
35/51S	34·6	1·48	34·3	100·3	0·49	33·1
Spratt-Archer ...	33·9	1·43	32·5	100·3	0·48	33·6
1936.						
35/7	41·9	1·43	42·2	100·5	0·52	36·3
Plumage Archer 1924	41·3	1·48	39·5	100·7	0·54	36·5
New Cross	36·8	1·50	35·8	100·1	0·48	32·0
Spratt-Archer ...	37·7	1·41	42·2	100·7	0·49	34·8
35/51S	38·2	1·50	41·8	99·8	0·51	34·0
Spratt-Archer ...	37·7	1·41	42·2	100·7	0·49	34·8

Table III.

QUALITY OF BARLEY AND OF MALT, 1933-1936.

Average figures for all stations.

Name of variety and year of trials	BARLEY			MALT		
	1000 corn weight grams dry	Percentage of nitrogen dry	Valuation shillings per 448 lb.	Extract brewers' lb. per 336 lb. dry malt	Permanently soluble nitrogen percentage dry	P.S.N. of dry malt as percentage of total nitrogen of dry barley
Golden Archer ...	38·9	1·43	42·0	100·7	0·46	35·6
Spratt-Archer 1933-1934	37·2	1·45	41·0	100·2	0·47	35·7
Beaven's 35/7	39·8	1·42	39·7	100·5	0·46	35·4
Plumage Archer 1924, 1934, 1935, 1936 ...	39·4	1·46	38·8	100·6	0·48	35·7
New Cross	34·8	1·49	32·2	100·2	0·47	32·7
Spratt-Archer 1934, 1935, 1936	35·6	1·42	35·8	100·4	0·46	34·4
35/51S	36·4	1·49	38·0	100·0	0·50	33·6
Spratt-Archer 1935, 1936	35·4	1·42	37·3	100·5	0·48	34·2

REPORT OF THE POTATO SYNONYM COMMITTEE

ON THE POTATOES SENT FOR IMMUNITY TRIALS TO THE POTATO TESTING STATION, ORMSKIRK, LANCASHIRE, 1937.

The following served on the Committee :—

F. J. Chittenden, F.L.S.	R. B. Strang, N.D.A.
W. D. Davidson, B.A., B.Sc.	B. C. C. Waight
A. A. McAlister	

and

Redcliffe N. Salaman, M.D., J.P., F.R.S. (Chairman).

Although the growing season was relatively dry the stocks grew vigorously but as the activities of wart are dependent on the amount of moisture present in the soil the incidence of the disease was slight. There was no trace of potato sickness or blight.

Three stocks which proved susceptible in the laboratory failed to develop wart in the field, but two were subsequently found whilst growing to be indistinguishable from established susceptible varieties—Plot No. 80 (May Queen) and Plot No. 76 (British Queen, bolter type) — thus demonstrating the accuracy of the laboratory test. The third stock, Plot. No. 54, proved to be a distinct seedling, but as experience has shown that the laboratory test is so reliable, the Committee had no hesitation in classing this seedling as susceptible.

The number of plots under consideration was 57, but two " too poor to be judged " were excluded, leaving a total of 55. Besides the two susceptible stocks which were found to be indistinguishable from established susceptible varieties mentioned above, a third entry under a number, Plot No. 81, proved to be indistinguishable from the immune variety Arran Comrade. The Committee welcome such unnamed stocks being entered for the trials as a means of preventing old varieties being inadvertently catalogued under new names. Plot No. 76 (British Queen, bolter type) was of interest. Although the differences between the habit of growth, the time of maturity and even the tuber shape of the bolting and normal types are very pronounced and would mislead the grower, the abnormal types cannot be considered as constituting distinct varieties. Plot No. 83, although known to be a genuine seedling, resembled Arran Pilot too closely to be differentiated, and is accordingly classed as a synonym.

Early in the year an examination was made of catalogues obtained from a large number of seed merchants not previously included in the annual survey. In most of the catalogues well-known synonymous names occurred,

e.g. Midlothian Early, Sir John Llewellyn and Factor, which have long been recognized as alternatives for Duke of York, Eclipse and Up-to-Date respectively. Letters were written to all the firms concerned, who agreed practically unanimously to discontinue their use.

As in previous years, stocks of suspected synonyms other than those of the type just mentioned were purchased and planted alongside their type varieties. An examination of the table on page 3 shows that such stocks have now been almost entirely eliminated. The Committee desire to express their appreciation of the co-operation of the seed potato trade in producing this healthy state of affairs.

The following groups of entries have been examined :—

Stocks indistinguishable from established varieties, including one bolter type	4
Stocks too poor to be judged	2
Interdepartmental stocks :	
(a) Distinct and free from wart disease ...	5
(b) Synonymous stocks	1
Distinct variety susceptible to wart disease	1
Distinct variety of doubtful immunity	1
Distinct varieties free from wart disease ...	43
Total number of plots under examination ...	57

The Committee have much pleasure in recording their satisfaction with the layout and maintenance of the trials. To Mr. Bryan and Mrs. McDermott they would once more express their debt of gratitude for the unstinted help afforded them. They would also like to record their warm appreciation to Mr. Sharrock and his staff for the efficient husbandry of the trial ground.

(Signed on behalf of the Committee),

REDCLIFFE N. SALAMAN.

I. STOCKS INDISTINGUISHABLE FROM ESTABLISHED VARIETIES AND BOLTER TYPES.

Plot No.	Variety.	Sender.	Incidence of Wart Disease
		ARRAN COMRADE.	
81	No. 2	S. Finney & Co. Ltd., Newcastle-upon-Tyne	No wart seen.
		ARRAN PILOT.	
83	S.7	C. T. Spence, Dunbar	No wart seen.
		BRITISH QUEEN (bolter type)	
76	Hillcrest	R. A. Butler, Skerries, Co. Dublin	No wart in field, lab. and pot test positive.
		MAY QUEEN.	
80	No. 1	S. Finney & Co. Ltd., Newcastle-upon-Tyne	No wart in field, pot test positive.

II. STOCKS TOO POOR TO BE JUDGED.

87	Mixed Grill	R. Carrington Willis, High Wycombe	No wart seen.
88a	Ellington's Coronation	J. Ellington, Bury St. Edmunds	No wart seen.

III. INTER-DEPARTMENTAL CHECK VARIETIES.

DISTINCT VARIETIES FREE FROM WART DISEASE IN THE FIELD.

90	K.33 (Harper)	Department of Agriculture for Scotland	No wart seen.
91	139a (67) S.S.R.P.B.	ditto	,, ,, ,,
92	398a (19) S.S.R.P.B.	ditto	,, ,, ,,
93	H.134 (Spence)	ditto	,, ,, ,,
95	13125 (McGill & Smith)	ditto	,, ,, ,,
		GREAT SCOT.	
94	S.1 (Scott)	Department of Agriculture for Scotland	,, ,, ,,

IV. DISTINCT VARIETY SUSCEPTIBLE TO WART DISEASE.

54	No. 2	J. Bailiff, Frizington, Cumberland	No wart in field, pot test positive.

V. DISTINCT VARIETY OF DOUBTFUL IMMUNITY.

88	Baldwin	J. Sumner, Bickerstaffe, Ormskirk	No wart in field, lab. test doubtful.

VI. DISTINCT VARIETIES FREE FROM WART DISEASE IN THE FIELD.

Plot No.	Variety.	Sender.
SECOND YEAR STOCKS.		
2	222/8	D. MacKelvie, Lamlash
4	233/10	ditto
7	233/11	ditto
9	233/13	ditto
12	233/44	ditto
15	234/6	ditto
17	234/11	ditto
19	33120	McGill and Smith Ltd., Ayr.
22	3328	ditto
25	A.40	Wm. B. Pollock, Bishopton, Renfrewshire
27	90/34	ditto
30	5147	Sutton & Sons Ltd., Reading
32	5149	ditto
35	5173	ditto
38	5178	ditto
40	5191	ditto
42	317a (3)	Scottish Society for Research in Plant Breeding, Edinburgh.
FIRST YEAR STOCKS.		
45	26/34	Wm. B. Pollock, Bishopton, Renfrewshire
47	84/34	ditto
48	94/34	ditto
50	101/34	ditto
51	117/35	ditto
53	No. 1	J. Bailiff, Frizington, Cumberland
56	No. 4	ditto
57	No. 6	ditto
58	No. 8	ditto
60	No.10	ditto
62	7341	McGill & Smith Ltd., Ayr.
65	7344	ditto
66	5184	Sutton & Sons Ltd., Reading
67	5188	ditto
68	5189	ditto
70	222/5	D. MacKelvie, Lamlash
71	222/21	ditto
72	232/30	ditto
73	233/12	ditto
74	233/63	ditto
78	318 (38)	Scottish Society for Research in Plant Breeding, Edinburgh
82	H.202	C. T. Spence, Dunbar
84	E.141	ditto
85	E.162	ditto
86	Miss Vince	R. Carrington Willis, High Wycombe
112	No. 2	Dr. Redcliffe N. Salaman, Barley, Royston

REPORT ON PURCHASED STOCKS OF SYNONYMS, 1937.

Name under which stock was purchased.	Vendor.	Result of examination in 1937. Synonymous with	When previously tested found to be synonymous with
Perkin's Renown	Wood & Ingram, Ltd., Huntingdon	Snowdrop	This synonym has not been purchased from this firm previously.
Cherub	D. & W. Croll, Ltd., Dundee	Duke of York	Duke of York
Early Favourite	S. Finney & Co. Ltd., Newcastle-upon-Tyne	Sharpe's Express	Sharpe's Express.
Cleadon Park	ditto	Duke of York	Red King Edward VII
Lord Allendale	Wm. Fell & Co. (Hexham) Ltd.	Red King Edward VII	This synonym has not been purchased from this firm previously.
Factor	T. Fewster & Sons (Ragworth) Ltd., Stockton-on-Tees	Majestic	This synonym has not been purchased from this firm previously.
Factor	G. R. Cross & Son, Henley-on-Thames	Up-to-Date	This synonym has not been purchased from this firm previously.

LORD DERBY GOLD MEDAL TRIALS, 1937.

H. BRYAN, B.Sc.

SECOND EARLY TRIAL.

DUNBAR ROVER (C. T. SPENCE).

This variety was entered as a second-early of outstanding cooking quality and was accordingly tested against British Queen and King Edward. The trial consisted of eight randomized drill plots of each variety, each drill consisting of 50 cut setts, and was planted on the 16th April, when the sprouts were just breaking. The drills were drawn 28 inches apart, the spacing between the setts being 16 inches.

The condition of the seed of the controls was described as "very good" but some of the tubers of Dunbar Rover showed mechanical damage.

Growth was vigorous and uniform but was somewhat checked by the dry conditions of mid-summer and the hot weather conditions in early August, Dunbar Rover being less affected than the two controls. The King Edward stock was mature by the 21st August, British Queen by the end of the month and Dunbar Rover by the 8th September.

All stocks were ostensibly virus free, there were no misses and no blight occurred.

The trial was carefully lifted by hand, riddled and weighed on the 9th September.

YIELD.

	Tons per acre (ware over 1⅝")			Percentage
	Ware.	Chats.	Total.	ware.
British Queen ...	12·7	4·0	16·7	76
Dunbar Rover ...	12·7	1·5	14·2	89
King Edward ...	8·7	6·0	14·7	59
Significant difference .	1·4			

The yields of ware of Dunbar Rover and British Queen were identical and significantly outyielded King Edward.

In view of the fine sample of long oval shaped shallow-eyed tubers; the low proportion of chats; the complete absence of cracking, second-growth and internal blemish; the excellent cooking quality as judged by many tests, and the desirable and distinctive type of broad-leaved foliage, the Committee were unanimous in awarding Dunbar Rover a Gold Medal.

DESCRIPTION OF DUNBAR ROVER.

Sprout : Pink.

Tuber : Oval; skin white; flesh white; eyes shallow.

Haulm and Foliage : Tall, upright; leaf open; leaflets long and broad, dull; leaflet stalks long; secondary leaflets large and often borne on leaflet stalks; wings broad; stems thick and strong, green, pink towards maturity.

Flowers : White, large and numerous; flower stalks long and strong; buds pink.
Maturity : Late second-early.

LATE MAINCROP TRIAL.

DUNBAR ARCHER (C. T. SPENCE).

The control varieties used in this trial were Scottish commercial stocks of Kerr's Pink and Up-to-Date, and the same method of layout was employed as for the Dunbar Rover trial.

The trial was planted on the 16th April when the sprouts of all stocks were just breaking. The condition of the seed of the controls was good but some of the tubers of Dunbar Archer were mechanically damaged. The growth of the plots was irregular, that of Dunbar Archer markedly so, a fact which was noticed as late as mid-July.

There were three misses in the Kerr's Pink stock and one each in the Up-to-Date and Dunbar Archer stocks. Nine plants (2·25%) showing severe secondary virus symptoms were present in the Kerr's Pink stock. The Up-to-Date stock was ostensibly virus free but tip-burn was prevalent in mid-summer. The Dunbar Archer stock was ostensibly virus free.

The relatively dry growing season and the hot weather of August somewhat hastened the maturity of the stocks. Dunbar Archer and Kerr's Pink were considered mature by the 4th October and Up-to-Date, a variety which shows resistance to adverse weather conditions, on the 7th October, when the whole of the trial was carefully lifted, riddled and weighed.

YIELD.

	Tons per acre (ware over 1⅝")			Percentage
	Ware.	Chats.	Total.	ware.
Up-to-Date	14·0	3·1	17·1	81
Dunbar Archer ...	11·2	1·7	12·9	87
Kerr's Pink	10·2	3·0	13·2	77
Significant difference .	0·8			

Yields of ware : Up-to-Date outyielded both Kerr's Pink and Dunbar Archer, and Dunbar Archer outyielded Kerr's Pink.

The Gold Medal Committee were not impressed by the yield of Dunbar Archer, the tuber shape (many showed severe cracking) or the appearance of the stock whilst growing, and accordingly no award was made. In view, however, of the excellent cooking reports received it was decided to allow the introducer to enter the variety, free of charge, for a further year's trial should he so desire.

DESCRIPTION OF DUNBAR ARCHER.

Sprout : Blue.
Tuber : Short oval; skin white; flesh white; eyes shallow to medium.
Haulm and Foliage : Tall, upright; leaf rigid, leaf and leaflet stalks tinged pink; leaflets medium green and pointed; secondary leaflets numerous; wings very wavy; stems very strong, branching freely, mottled.
Flowers : White, fairly profuse, anthers orange; buds pink.

POTATO TRIALS, ORMSKIRK, 1937.

H. BRYAN, B.Sc.

TRIAL OF FIRST EARLY VARIETIES.

In view of the popularity of different early varieties in different districts, e.g. Duke of York and Sharpe's Express in Lincolnshire and Ninetyfold in Lancashire, a trial of the three varieties was carried out at Ormskirk to discover whether Duke of York and Sharpe's Express are suitable commercial varieties when grown under Lancashire conditions. The new immune early variety Arran Pilot was also included.

Fresh Scottish seed of all varieties was obtained from reliable sources in Scotland during the month of January and immediately boxed. All stocks received exactly the same treatment. It was found at planting time that the average length of the sprouts was as follows :—

Arran Pilot	2″
Ninetyfold	$1\frac{3}{8}$″
Duke of York	$1\frac{1}{8}$″
Sharpe's Express	$\frac{3}{8}$″

The trial consisted of eight scattered plots of each variety, each plot consisting of a drill planted with 50 cut setts. There were 28 inches between the drills and 10 inches between the setts. In addition large surplus plots of each variety were planted adjacent to the trial.

Planting took place on the 12th April. Cultivation and manuring were in accordance with the best practice in the district.

The growth of the trial was vigorous and uniform throughout. The Sharpe's Express and Ninetyfold stocks were ostensibly virus free. Two mild mosaic plants were present in the Duke of York stock, and two severe and twenty mild mosaic in the Arran Pilot stock.

Lifting of the whole trial took place on the 8th July, when it was judged from trial liftings of the auxiliary plot of Ninetyfold that this variety would be dug commercially. The produce was graded by eye and the results obtained are shown in the following table.

YIELD.

	Tons per acre. Marketable.	Non-Marketable.	Percentage ware.
Arran Pilot	11·0	1·3	90
Ninetyfold	9·0	1·2	88
Duke of York ...	8·7	1·6	84
Sharpe's Express ...	7·4	1·6	82
Significant difference ...	0·8	—	—

All varieties significantly outyielded Sharpe's Express. Arran Pilot significantly outyielded Ninetyfold and Duke of York; there was no significant difference between Ninetyfold and Duke of York.

The figures scarcely give a true reflection of the results. The tubers of Arran Pilot were individually larger than those of the other varieties; the Sharpe's Express tubers being much smaller and more numerous, many of them on the dividing line between marketable and non-marketable produce, a result which was anticipated by the slow sprouting of this variety and the periodic lifting of the plants in the surplus plots.

It was clear from the trial that Sharpe's Express was unsuitable for early lifting when grown under Lancashire conditions. There was no apparent difference in the early bulking capacities of Ninetyfold and Duke of York, but the yellow colour of the flesh of the latter variety renders it unsuitable for the Lancashire market.

DOON EARLY v. EPICURE.

A Gold Medal was awarded to Doon Early in 1936, the evidence obtained from the trial in that year being that it was at least a week earlier in bulking than the established early variety Epicure. A trial against that variety was accordingly repeated in 1937.

The seed of Doon Early was supplied by the raisers, Messrs. McGill & Smith, Ltd. of Ayr, and stock seed of Epicure was used. The same method of layout was employed as for the Sharpe's Express, Duke of York, Ninetyfold and Arran Pilot trial.

The condition of both stocks of seed was extremely good. Doon Early, owing to unforeseen circumstances, was received three weeks before the stock of Epicure, but every endeavour was made to retard its sprouting until the Epicure arrived, when both stocks were boxed and received exactly the same treatment; however, at planting time the sprouts of Doon Early were 2″ to 2½″ long whilst those of Epicure were only ½″ long.

The trial was planted on the 12th April, large surplus plots being planted adjacent to it. Growth was vigorous and uniform, and no virus was seen.

Preliminary liftings of plants from the surplus plots showed that the tubers of Doon Early were of saleable size by mid-June. Had the trial been lifted at that date the saleable produce of Epicure would have been negligible. The trial was accordingly not lifted until the 29th June when it was seen from the surplus plot of Epicure that it was ready for lifting.

The produce was graded by eye and the results are shown in the following table.

YIELD.

	Tons per acre.		
	Marketable.	Non-Marketable.	Total.
Doon Early	7·8	0·5	8·3
Epicure	6·0	1·6	7·6
Significant difference ...	0·63	—	—

At lifting time the tubers of Doon Early were much larger than those of Epicure, the average number of tubers per plant was six and the proportion of chats in the produce extremely low. The trial confirmed the result obtained in the previous year and indicated that Doon Early is eminently suitable for lifting at the beginning of the early potato season when luxury prices are obtaining.

MAINCROP TRIAL.

REDSKIN AND KERR'S PINK.

In 1936 a Gold Medal was awarded to Redskin as a suggested substitute for Kerr's Pink, this year it has been tested against that variety.

Stock seed of both varieties was obtained and boxed on the 28th January. The trial was planted on the 15th April and consisted of 36 drills — 18 drills of each variety in 6 blocks of 3 drills each with 30 whole setts per drill. The three-drill plots were adopted instead of the single-drill plots to determine whether any interference of the growth of Redskin by the more vigorous and taller growing Kerr's Pink occurred.

As in some of the other yield trials the maturity was hastened by the dry growing season and the hot spells of weather in midsummer. Growth was normal in the early stages and by the beginning of July the haulms of Kerr's Pink were some 10 inches taller than those of Redskin. With the exception of a mild mottle in the lower leaves of occasional plants in the Redskin plots, no virus was recorded.

Redskin matured somewhat irregularly but with the exception of one plot was considered mature by the 7th September; this plot, however, did not mature till the 28th September, when the variety was lifted. Kerr's Pink did not mature till the 5th October and was lifted on that day. The produce of each drill of the trial was weighed separately.

YIELD.

	Tons per acre (ware over $1\frac{5}{8}$")			Percentage
	Ware.	Chats.	Total.	ware.
Kerr's Pink ...	14·0	3·3	17·3	81
Redskin	11·8	3·5	15·3	77
Significant difference	1·4			

An analysis of the results showed that there was no interference by the Kerr's Pink, which in this trial significantly outyielded Redskin.

MAJESTIC STOCK SEED TRIAL.

A yield trial was carried out with the variety Majestic with stocks from various sources, all of which were stock seed or of a corresponding grade. It is realised that this trial, like the majority of the yield trials carried out by the Institute on potatoes, is open to the criticism that it deals only with super grades which cannot be considered as representative of commercial stocks. It is, however, the function of the Institute to demonstrate the results obtained from " better " seed and to encourage as far as possible its use.

The trial consisted of eight randomized single drill plots of each stock. The drills were drawn 28 inches apart and consisted of 70 whole setts with 16 inches spacing. A large single plot of each stock was planted for demonstration purposes.

All stocks were graded 2¼″ by 1¼″, and with the exception of that from the Irish Free State which consisted of larger tubers, were remarkably uniform in size. The condition of all stocks was described as good. The sprouts were approximately ¼″ long at planting time. The trial was planted on the 21st April. Growth was normal until the beginning of August when the effects of prolonged dry hot weather on the foliage was observed. Although the maturity of all stocks was hastened, conditions were alike for all. In the early stages of the trial the growth of the Irish Free State stock was outstandingly vigorous, the foliage being of a bright green colour and this stock was the first to succumb to the weather of August, little growth taking place after the first of that month. The North Wales stock on the other hand was not mature until the first week of September. All stocks were carefully lifted by hand during the week ending 18th September. No blight occurred.

The table below gives the statistical analysis of the yield results and the sources of origin of the seed.

	Tons per acre. Total yield.	Tons per acre. Ware yield. (1⅝″)	Percentage ware.
Aberdeenshire ...	14·4	10·5	73
Ross-shire	13·6	10·0	73
Northern Ireland (11215)	13·6	9·3	68
,, ,, (11220)	13·3	9·2	70
Cumberland	12·9	9·2	71
North Wales	12·6	9·1	72
Irish Free State ...	12·2	8·9	73

Yield of ware.—Standard error = 0·34 tons per acre, and a difference of 1·1 tons per acre is statistically significant, i.e. the Aberdeenshire stock significantly outyielded all except the stock from Ross-shire, and the latter outyielded that from the Irish Free State, but no other difference was significant.

The Aberdeenshire and Cumberland stocks each showed two plants (·35%) of mild mosaic. Four plants (·7%) with secondary virus symptoms were present in the Northern Ireland (No. 11220) stock, and 36 (6·4%) in the North Wales stock.

BEDFORDSHIRE POTATO TRIALS, 1936/37.

B. BRANDRETH, M.A., and J. W. DALLAS, M.Sc.

In 1936, in co-operation with the Bedfordshire County Agricultural Education Sub-Committee, it was decided to start a series of trials of early potato varieties in order to determine their relative earliness and cropping capacity.

The chief difficulty lay in estimating the true value of Arran Pilot to the growers, for whereas on one type of soil the variety was thought to be outstanding, on others there was evidence that it was not as early as some of the older varieties.

Arran Pilot was therefore compared with Epicure and Ninetyfold in replicated trials on a market garden type of soil on the green-sand at Flitton and on a gravel soil at Maulden. In 1937 a small quantity of Doon Early was available, and was tested at Flitton. Scotch seed was used throughout. Each trial consisted of six randomized single-drill plots of each variety, and the rows were divided into three parts for lifting on three different dates in 1936 and into two parts for lifting on two dates in 1937.

In 1936 the stocks of Epicure and Arran Pilot both produced a large proportion of virus-affected plants, amounting at Maulden to 18 and 19 per cent. respectively. The 1937 stock of Epicure was practically virus-free, and Arran Pilot was affected to the extent of less than 1 per cent. In 1936 Ninetyfold produced just over 2 per cent. of leaf-rolled plants, and the majority of the plants were also affected by " aucuba mosaic ". The latter was less apparent in the 1937 stock, while no other virus symptoms were seen. Throughout the work, it was observed that virus symptoms were more in evidence at Maulden than at Flitton, although the relative proportions of virus-affected plants in the different varieties were similar. It is thought the better growing conditions at Flitton tended to mask the symptoms.

The following table shows the dates of planting and lifting and the yields on the different dates :—

Trial centre	Date of planting	Date of lifting	Saleable produce (tons per acre)			
			Epicure	Ninetyfold	Arran Pilot	Significant difference
1936 Flitton ...	3rd April	19th June	5·0	6·1	5·5	0·5
		24th June	8·0	8·4	8·2	0·7
		30th June	11·0	10·9	11·4	1·1
1937 Flitton ...	13th April	23rd June*	6·2	6·7	5·8	0·9
		30th June	9·2	9·0	8·7	1·0
1936 Maulden .	20th March	2nd July	7·9	9·8	9·7	0·6
		7th July	8·6	11·0	10·6	1·0
		14th July	12·4	13·1	12·8	1·6
1937 Maulden .	1st April	22nd June	4·2	5·4	5·4	0·7
		29th June	6·1	6·5	7·1	1·0

* Doon Early, included in the section of the trial at Flitton lifted on 23rd June, produced 7·2 tons per acre.

FLITTON (GREENSAND).

Boxing at Flitton took place during the second week in January in each year. The boxes were stored in a poor light and the shoots of Arran Pilot were rather long at planting time, although the other varieties had satisfactorily sturdy sprouts. The trials were planted on 3rd April in 1936 and 13th April in 1937.

The trial area was open, with a slight slope to the south; the two years' trials were grown on different parts of the same field, following beet in 1936 and brussels sprouts in 1937. In each year the potatoes received 20 - 25 tons per acre of London manure and 8 cwt. of a compound artificial.

The varieties grew vigorously, and were undamaged by frost. The number of misses was negligible.

At the first lifting in 1936, Ninetyfold gave a significantly higher yield of saleable tubers than either Epicure or Arran Pilot, and also produced a much bolder sample. In fact, neither of the other varieties were really fit to lift commercially. The yields at the second lifting were much alike, although the sample of Arran Pilot was still on the small side, and the same remarks apply to the third lifting. It was obvious that had the Arran Pilot plots been left for another week they would have given a very heavy crop indeed.

The results of the 1937 trial were similar, although Epicure made a better showing, presumably owing to the use of a better stock of seed. Arran Pilot gave a satisfactory sample at the later lifting, but was clearly less suitable than Ninetyfold for the earliest crop.

Doon Early, grown in 1937 only, was fit to lift a week in advance of the first lifting date, but was left until the 23rd June, when the other varieties could be lifted. The tubers were then on the large side, and it was obvious that it was definitely earlier than Ninetyfold.

MAULDEN (GRAVEL).

The seed for the two trials was boxed during the first week in January and the last in December respectively. At planting time the sprouts were rather more backward than at Flitton, those of Arran Pilot in each year being more forward than the other varieties. The trials were planted on the 20th March in 1936 and on the 1st April in 1937.

The trial area was open and reasonably level, and, as at Flitton, the same field was used in both years, the previous crops being brussels sprouts in each case. The 1935 crop of brussels sprouts received 2 tons of shoddy per acre, but none was applied in 1936, nor did either of the potato crops receive any organic manures. 10 cwt. of mixed artificials were applied to the potatoes in each year, the composition being as follows :—

3 cwt. Sulphate of Ammonia
2 cwt. Sulphate of Potash
4 cwt. Superphosphate
1 cwt. Steamed Bone Flour.

In 1936 the plants were slow to appear, and development continued to be much slower than at Flitton.

Growth was very much more satisfactory in 1937, and in the earlier stages the plots seemed likely to be earlier than those at Flitton. That this did not prove to be the case is evidence of the great difference between soil conditions at the two centres.

As has been noted, virus symptoms were very obvious at Maulden and sound comparison of the varieties is correspondingly difficult. It was clear, however, that Epicure was less suitable than either Ninetyfold or Arran Pilot, these latter giving similar returns at each lifting. In view of the large amount of virus present in Arran Pilot, this result pointed to the possible superiority of a healthy stock of that variety.

In 1937, however, in spite of the improved standard of health of the stocks used, the results were much the same as in 1936. Epicure was inferior in yield at each lifting, while Arran Pilot was similar to Ninetyfold both in earliness and in the size of the samples at each lifting. On the other hand, Arran Pilot was more attractive in shape than Ninetyfold, and might be more saleable in some seasons.

The amount received for the produce of each variety from the different trials was noted, but the values were clearly dependent on the day to day state of the market, so that all that can usefully be recorded is that there was at no time any difference between the cash values of Arran Pilot or Ninetyfold.

SUMMARY.

Trials of Arran Pilot, Ninetyfold and Epicure were carried out on two soils in Bedfordshire in 1936 and 1937 to determine their relative suitability as first earlies.

Epicure throughout gave the lowest yields at the earlier liftings. Arran Pilot was inferior to Ninetyfold in the earlier liftings on the more fertile of the two soils, but was similar in the later liftings and in all liftings on the less fertile soil.

The position of Ninetyfold as the most popular first early potato in the county appears to be justified, although on some soils Arran Pilot may give an equally early crop.

Doon Early, included at one centre during 1937 only, gave promising results, but no definite recommendation can be made until the variety has undergone at least one further year's trial at both centres.

THE OFFICIAL SEED TESTING STATION FOR ENGLAND AND WALES.

TWENTIETH ANNUAL REPORT

Covering the period 1st AUGUST, 1936—31st JULY, 1937.

A. EASTHAM, D.S.O., M.C., B.Sc., and C. C. BRETT, M.A.

The amount of work falling upon the Station during the period covered by the following report was phenomenally heavy, the total number of samples received for analysis during the season reaching 33,889. This figure is higher than that of any preceding season and is 4,019 or 13·5% more than the previous record of 1935-36. As a further comparison, the present season's figure shows an increase of more than 9,000 samples, or 36·3%, over the average of the previous eighteen seasons. In addition to these samples, all of which were received from various outside sources, it was necessary, as in previous years, to make a number of tests of an investigational character. These tests amounted to 2,170, bringing the total of samples tested during the twelve months ending 31st July 1937 to 36,059.

SOURCES OF SAMPLES RECEIVED.

The various sources, from which the samples tested were received, are shown in Table I, together with the number of samples from each source. The number of samples received from farmers includes only those tested for farmers and growers at the special reduced fee, i.e. where the results of the tests were to be used for seeding and not for sale purposes. In those cases where the samples submitted by farmers were for sale purposes, to enable the senders to comply with the provisions of the Seeds Act 1920, the full fees were charged and the number of such samples has been included in the figure representing the number of samples from seed firms. Samples from public departments include all samples taken by Inspectors of the Ministry of Agriculture, in connection with the administration of the Seeds Act.

Very satisfactory increases are recorded under each heading in Table I, with the exception of the number of samples from public departments, where there is a slight decrease compared with the previous season. The number of samples from seed firms and from farmers constitutes a record in each case, the respective figures being higher than in any preceding season and showing very substantial relative increases over the immediately preceding season. The number of farmers utilizing the services of the Station has again risen to a high level, having only once been exceeded. It is interesting to note that the number of seed firms sending samples has remained in the region of 1,500 for the past few seasons, but that the average number of samples received per firm has steadily risen during this period, reaching 17·4 samples per firm in the season under review.

Table 1. *Shows sources of samples received.*

			1936-37	1935-36	1934-35
Seed Firms.	Number	sending Samples ...	**1547**	1519	1502
,, ,,	,,	of samples received ...	**26878**	23397	22652
Farmers, etc.	,,	sending samples ...	**1173**	877	665
,, ,,	,,	of samples received ...	**3027**	2410	1821
Public Depts.	,,	of samples received ...	**3984**	4063	3854
Total number of samples			**33889**	29870	28327

DISTRIBUTION OF SAMPLES ACCORDING TO SPECIES.

The number of samples of each kind of seed received during the season is shown in Table II, together with the total of samples in each group and corresponding figures for the two previous seasons.

The total increase in numbers over the season 1935-36, recorded earlier in this report, is accounted for mainly by the large increase in cereal samples, the increases in the clover and grass groups being largely offset by the decreases in the pulse and root and vegetable seed groups.

The number of wheat samples received is the highest yet recorded and exceeds the record of the previous season by just over 1,500. Increases over the preceding season are shown by all the members of this group except rye, the increases in the case of both barley and oats being almost as noteworthy as that of wheat. In the case of barley the increase is one of some 850 and in that of oats almost 1,500; in each case this season's figure has only once been exceeded. The total increase, in this group, over the previous season amounts to just over 3,800 samples. The pulse group shows a total decrease of a little over 120 samples, due chiefly to a falling off in the number of pea samples. Although the total of samples in the vegetable and root seed group is not substantially less than in the previous year, yet within the group there occur some significant changes. All the brassica species, except rape and cabbage, shows relative decreases of some magnitude, as do all the root seeds except beet. The number of samples of this seed is the highest yet recorded, being 230 more than in the preceding season.

The total of samples in the clover group is the highest since 1921-22 and within the group red clover, trefoil and sainfoin, all show relatively substantial increases, compared with the previous season. White clover and crimson clover both give figures rather lower than the previous year. The number of red clover samples is higher than in any preceding season.

The increase in the total number of grass samples received is due to a general increase throughout the group, the only decrease being in the case of mixtures. The total for the group is the highest yet recorded and within the group, the figures for dogstail and for " other grasses " are both higher than in any previous season. As has been noted in other reports of recent years, the heading " other grasses " includes the so called " natural grasses ", many of which are now used extensively in sports turf production. Confidence in the Station's ability to deal successfully with these difficult species and the increased demand upon the trade for grasses for lawn and sports turf purposes is no doubt reflected in the phenomenally large number of these samples received in the season under review.

Table II. *Shows number of samples of different kinds of seeds tested.*

	1936-37	1935-36	1934-35
Cereals			
Wheat	**7499**	5991	4896
Barley	**2562**	1705	1265
Oats	**5743**	4270	4638
Rye	**135**	176	157
Maize	**62**	47	33
	16001	12189	10989
Pulses			
Peas	**1772**	1895	1711
Beans	**483**	503	454
Vetches	**364**	343	331
	2619	2741	2496
Roots and Vegetables			
Turnip	**427**	475	469
Swede	**526**	598	648
Rape	**78**	74	60
Kale	**383**	405	342
Cabbage	**569**	556	495
Brussels Sprouts	**124**	127	110
Broccoli and Cauliflower ...	**335**	374	377
Other Crucifers	**128**	146	152
Mangold	**782**	804	934
Beet	**1019**	789	715
Onion	**441**	495	483
Parsnip	**113**	132	139
Carrot	**310**	351	320
Other Vegetables	**234**	219	276
	5469	5545	5520
Clovers			
Red Clover	**3062**	2930	2887
Alsike	**205**	213	236
White Clover	**1101**	1172	1103
Trefoil	**543**	474	367
Lucerne	**99**	114	127
Sainfoin	**276**	240	271
Crimson Clover	**110**	173	141
Other Legumes	**56**	44	41
	5452	5360	5173
Grasses			
Perennial Ryegrass	**1035**	1002	1027
Italian Ryegrass	**538**	443	506
Cocksfoot	**299**	286	332
Timothy	**202**	198	273
Meadow Fescue	**85**	81	101
Crested Dogstail	**277**	214	235
Other Grasses	**1205**	1051	1022
Mixtures	**352**	386	370
	3993	3661	3866
Linseed	**52**	63	36
Forest Trees	**106**	104	93
Miscellaneous	**197**	207	154
	355	374	283

SAMPLES RECEIVED EACH MONTH.

The distribution of samples per month during the season is shown in Table III, together with comparable figures for the previous season. In September and October the number of samples received exceeds the average of all previous seasons, by some 1,400 in the former and by over 2,500 in the latter month. The figures for September, October, December, April and July are all higher than any other previously recorded for these months. Although the general direction of a curve plotted from this season's figures follows that of the average of all previous seasons, yet the actual figures for the season exceed the averages to an appreciable extent in every month except August and January. The average number of samples received per working day is 170 for September and October and just over 200 for February and March, whilst the average per working day over the whole year is slightly in excess of 110 samples.

Table III. *Shows number of samples received per month.*

Season.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
1936-37 ...	**885**	**3331**	**5544**	**2722**	**2280**	**3009**
1935-36 ...	1067	3168	4264	2224	1812	2998
Season.	Feb.	Mar.	April	May	June	July
1936-37 ...	**5011**	**5337**	**3580**	**1004**	**519**	**667**
1935-36 ...	4615	5534	2401	928	425	434

PURITY AND GERMINATION.

In Tables IV, V, VI and VII are given figures indicative of the average quality of the various seed species tested during the season. In all tables there are included figures representing the average germination of each species and in Tables VI and VII average purity figures are given in addition. For comparative purposes, figures representing the total averages of all previous seasons are recorded and as a further indication of general quality, the percentage number of samples germinating below the minimum percentage of germination provided in the Seeds Regulations 1922, is given for each species for which such a standard has been prescribed. In the case of both grasses and clovers, the tables also include figures showing the percentage of samples found to contain one per cent. or more of " injurious weed seeds."

Of the seed species which are apt to lose vitality somewhat rapidly, more samples are met with amongst certain root and vegetable seeds than in any other class of seed and in most seasons the Station receives many samples of such seeds from stocks carried over from the previous season. Such samples are often of relatively low germination and in the majority of cases the bulks they represent would not be distributed. Consequently the figures in Table V do not necessarily reflect with accuracy the quality of the majority of bulks of root and vegetable seeds passing through the usual trade channels throughout the country.

Although, in the majority of the species listed in the following tables, the average germination for the season under review is equal to or above the

average of all previous seasons, yet in general, there is a decided falling off in quality as compared with the immediately preceding season.

For all the cereals the average germination figures are below the averages of all previous seasons, those for barley, oats and rye being appreciably lower. In the case of wheat, barley and rye the season's average figures are lower than in any season since 1931-32 and in the case of oats the figure is the lowest since 1922-23. As would be expected, there is a corresponding increase in the percentage of samples germinating below the authorised minimum prescribed in the Seeds Regulations 1922 and in each case the figure recorded is the highest for a number of years.

All the bean types show germination figures appreciably above the averages of all previous seasons, though in only one case, that of field beans, is this season's figure higher than that of the immediately preceding year. Peas, although lower than in the past three seasons, are still at about the average of all previous seasons. The average germination of vetches is lower than in the two preceding years, but above the general average.

Amongst the brassica species rape, kale and kohl rabi are somewhat above the average with regard to germination, whilst turnip, swede, cabbage, brussels sprouts and broccoli and cauliflower are all appreciably below the averages of all previous seasons and in each case show figures lower than have been recorded for some years. The average figure for mangold is the highest yet recorded, but in the case of both garden and sugar beet, although the figures are above the averages of all previous years, yet they are rather below those of the immediately preceding season. For parsnip and carrot the figures are still well above the average, though not quite so high as in the previous season. Onion is well below the average and some 10% lower than in the previous year, giving an average germination figure lower than in any season since 1927-28. Mustard, lettuce and radish are all lower than for several years, but celery is higher than in any year since 1925-26.

Amongst the scheduled grass species, perennial ryegrass, timothy and dogstail all show purity figures rather below average, whilst Italian ryegrass, cocksfoot and meadow fescue are rather above the averages of all previous seasons. In so far as average germination is concerned, perennial ryegrass, Italian ryegrass, meadow fescue and dogstail all show figures above the average of previous seasons, cocksfoot being the only species with an average germination lower than that of all previous years. The species not scheduled in the Seeds Regulations 1922 call for little comment, except that the average purity figure for tall oat grass is the highest and for sheep's fescue the lowest yet recorded. The average germination of Agrostis spp. is at a high level and that of tall fescue is higher than in any previous season. The very low average purity figure for red fescue is explained by the fact that the figure is considerably influenced by a rather large number of hand saved samples of very low purity received from one particular source.

In general, the average purity of the various species within the clover group is not so high as in the previous season, though in most cases the figures are rather above the averages of all preceding seasons. The average purity of red clover (all samples) is the lowest since 1932-33 and that of alsike the lowest since 1930-31. Lucerne shows a marked improvement in average purity, the figure recorded being higher than in any previous season. With regard to germination, most species show average figures below those of the immedi-

ately preceding season and well below the averages of all previous seasons. Particularly low average germination figures are recorded for red clover (all samples), English red clover, English white clover, Mid-European white clover, lucerne, sainfoin and crimson clover.

Table IV. *Shows percentage germination of cereals.*

	Number of samples included in the averages	Average percentage of germination		Percentage of samples below authorised minimum.	
		1936-37	1917-36	**1936-37**	1935-36
Wheat	7161	**95·2**	96·0	**7·4**	1·9
Barley	2351	**94·0**	95·2	**11·4**	6·8
Oats	5544	**91·1**	93·5	**9·5**	4·3
Rye	119	**86·8**	90·4	**16·0**	11·0

Table V. *Shows percentage germination of pulses and root and vegetable seeds.*

	Number of samples included in the averages	Average percentage of germination		Percentage of samples germinating below authorised minimum (authorised minimum in brackets)
		1936-37	1917-36	
Peas (Field and Garden)	1595	**88·3**	88·7	12·1 (80 F., 70 G.)
Beans (Field)	233	**97·0**	95·5	4·7 (90)
Beans (Broad)	57	**96·7**	93·9	1·8 (75)
Beans (Runner)	57	**86·5**	81·3	10·5 (60)
Beans (Dwarf)	51	**87·4**	84·5	17·6 (75)
Vetches	331	**91·0**	89·8	21·5 (90)
Turnip (Field and Garden) .	349	**81·6**	85·7	23·7 (80 F., 75 G.)
Swede	438	**81·5**	84·1	20·3 (80)
Rape	71	**90·9**	88·5	9·9 (80)
Kale	351	**81·4**	80·3	8·8 (70)
Cabbage	448	**77·0**	79·7	22·1 (70)
Brussels Sprouts	94	**76·1**	80·2	26·6 (70)
Broccoli and Cauliflower ...	275	**74·0**	76·0	16·7 (60)
Kohl Rabi	24	**80·0**	75·1	16·7 (70)
Mangold	658	**82·7**	76·6	7·7 (60)
Beet (Garden)	174	**74·9**	72·6	5·7 (50)
Beet (Sugar)	708	**86·5**	82·9	0·6 (60)
Parsnip	40	**78·0**	65·4	7·5 (45)
Carrot	185	**69·8**	65·2	3·8 (50)
Onion	307	**62·1**	69·5	38·4 (60)
Other seeds.		**1936-37**	1935-36	
Mustard	64	**82·1**	84·0	
Lettuce	51	**76·3**	82·5	
Radish	21	**80·6**	88·2	
Celery	102	**75·9**	70·5	
Parsley	23	**73·6**	74·4	
Spinach	15	**73·8**	78·0	
Flax	49	**92·7**	95·5	

Table VI. *Shows percentage purity and germination of grasses.*

	No. of samples included in the averages	Average percentage of impurities		Percentage of samples containing 1% or over of injurious weed seeds		Average percentage of germination	
		1936-37	1922-36	**1936-37**	1935-36	**1936-37**	1922-36
Perennial Ryegrass ...	861	**3·20**	2·92	**3·5**	12·3	**85·1**	83·2
Italian Ryegrass ...	461	**2·14**	2·77	**8·0**	16·3	**84·8**	83·2
Cocksfoot	247	**9·21**	9·82	**0·4**	0·5	**88·0**	89·2
Timothy	156	**1·58**	1·34	**2·5**	0·7	**89·3**	89·3
Meadow Fescue ...	70	**1·78**	2·40	**7·1**	0·0	**88·9**	84·2
Crested Dogstail ...	247	**4·88**	3·29	**0·8**	2·1	**86·4**	82·0

Other Grasses not scheduled in the Seeds Regulations, 1922.

		1936-37	1935-36			**1936-37**	1935-36
Hard Fescue	94	**9·0**	9·3			**86·2**	88·7
Tall Oat Grass ...	7	**4·5**	10·6			**87·0**	77·0
Agrostis spp.	53	**6·9**	10·6			**91·6**	90·9
Brown Top	120	**17·4**	3·9			**87·4**	93·1
Meadow Foxtail ...	13	**34·6**	33·2			**64·3**	66·0
Poa trivialis	109	**8·9**	9·3			**85·0**	85·7
Poa pratensis ...	128	**12·6**	12·3			**82·8**	81·0
Poa nemoralis ...	16	**16·6**	17·3			**81·1**	86·0
Chewing's Fescue ...	167	**1·6**	1·7			**86·4**	81·8
Sheep's Fescue ..	35	**23·5**	15·7			**73·0**	79·2
Tall Fescue	12	**6·8**	4·4			**89·8**	82·4
Red Fescue	149	**24·6**	11·4			**85·0**	84·8

Table VII. *Shows percentage purity and germination of clovers.*

	No. of samples included in the averages	Average percentage of impurities		Percentage of samples with 1% or over of injurious weed seeds		Average percentage of germination		Average percentage of hard seeds	
		1936-37	1917-36	**1936-37**	1935-36	**1936-37**	1917-36	**1936-37**	1917-36
Red Clover (All samples) ...	2493	**4·07**	3·59	**5·3**	1·9	**72·8**	78·8	**5·3**	4·8
„ „ (English) ...	940	**3·30**	3·22	**3·4**	1·9	**74·1**	79·1	**5·3**	5·3
„ „ (Chilean) ...	104	**0·89**	1·83	**0·0**	0·0	**85·1**	88·7	**7·0**	6·0
Alsike (All samples) ...	158	**4·88**	4·36	**0·0**	0·0	**84·9**	83·1	**6·3**	6·2
White Clover (All samples) ...	902	**5·88**	6·93	**3·0**	5·5	**76·8**	77·6	**10·7**	10·9
„ „ (English) ...	282	**4·34**	5·24	**2·5**	33·3	**75·7**	82·0	**13·0**	7·2
„ „ (Mid-European)	138	**3·30**	4·50	**1·5**	1·9	**81·5**	85·0	**6·3**	6·7
„ „ (New Zealand)	53	**1·64**	3·48	**0·0**	0·0	**85·0**	87·8	**8·6**	7·3
Wild White Clover	560	**6·42**	7·92	**2·0**	2·5	**75·2**	74·9	**13·3**	13·4
Trefoil	421	**0·76**	1·43	**0·2**	0·0	**80·1**	76·8	**2·9**	2·6
Lucerne	71	**0·97**	2·41	**0·0**	0·0	**73·4**	80·7	**7·9**	5·7
Sainfoin	230	**3·60**	3·09	**0·0**	0·0	**67·1**	72·7	**0·6**	0·6
Crimson Clover	81	**3·23**	3·20	**0·0**	0·0	**77·4**	81·0	**0·9**	0·5

DODDER IN CLOVER SAMPLES.

In Table VIII the percentage of samples found to contain seeds of clover dodder is given for each of the species examined, together with comparable figures for each of the preceding seasons. In the case of English and Chilean red clover and of lucerne, the figures recorded are lower than in any previous year.

Table VIII. *Shows percentage of samples containing dodder.*

	RED CLOVER.					
	All samples	English	French	Chilean	U.S.A.	New Zealand
1936-37	**5·3**	**0·1**	**0·0**	**69·2**	**0·0**	**0·0**
1935-36	6·1	0·9	—	81·1	6·2	—
1934-35	5·7	2·2	—	90·2	0·0	—
1933-34	6·2	1·6	0·0	95·7	8·0	0·0
1932-33	5·5	0·5	3·8	89·2	14·2	0·0
1931-32	3·6	0·8	0·1	92·0	8·3	0·0
1930-31	2·8	1·7	12·9	91·6	0·0	0·0
1929-30	4·0	1·5	0·0	80·0	33·3	0·0
1928-29	4·9	2·2	14·2	85·0	0·0	14·3
1927-28	8·5	3·4	13·9	86·6	0·0	0·0
1926-27	6·5	3·6	7·3	89·6	0·0	0·0
1925-26	7·2	3·2	9·7	89·1	0·0	25·0
1924-25	10·1	5·3	8·3	94·5	11·1	20·0
1923-24	10·5	5·9	8·0	98·5	0·6	1·4
1922-23	29·4	17·6	8·8	91·7	18·0	23·5
1921-22	21·8	10·2	18·2	83·6	0·0	0·0
1920-21	19·2	4·4	13·4	82·6	30·0	10·0
1919-20	18·9	3·4	15·4	81·1	10·1	0·0
1918-19	27·3	12·1	36·6	90·9	10·1	—

	ALSIKE	WHITE CLOVER.			ALSIKE AND WHITE	LUCERNE
		All samples	Mid-European	New Zealand		
1936-37	**0·6**	**0·3**	**0·0**	**0·0**	**2·0**	**1·4**
1935-36	0·0	0·5	1·9	0·0	2·7	3·2
1934-35	0·0	0·4	0·0	0·0	1·0	8·4
1933-34	0·0	0·0	0·0	0·0	1·0	5·1
1932-33	0·0	0·0	0·0	0·0	1·3	6·7
1931-32	0·0	0·1	0·0	0·0	2·4	9·4
1930-31	0·5	1·3	5·1	0·0	5·9	8·6
1929-30	0·6	0·6	4·4	0·0	9·7	8·7
1928-29	1·6	0·1	6·1	0·0	0·7	9·4
1927-28	0·0	0·1	5·6	0·0	0·0	5·9
1926-27	0·0	0·4	2·1	7·1	5·8	5·7
1925-26	0·0	1·5	0·0	12·5	0·0	11·3
1924-25	1·3	5·6	12·9	37·5	2·9	12·5
1923-24	1·0	2·4	0·0	66·6	2·0	11·1
1922-23	4·1	17·6	5·0	48·3	22·2	11·5
1921-22	6·4	4·5	3·5	25·0	7·9	7·3
1920-21	5·5	3·4	12·5	9·4	16·1	12·3
1919-20	6·1	3·1	11·1	0·0	13·6	12·2
1918-19	less than 1·0	1·3	—	—	less than 1·0	6·7

A dash sign, thus —, in this table indicates that no samples were received.

VARIETIES OF CEREALS.

The distribution of cereal samples according to variety is shown in Table IX. The figures recorded in this table are not necessarily correlated with the areas sown with the different varieties, but they afford an indication of relative popularity. As samples are sometimes received at the Station bearing no varietal name, two sets of figures are shown for each variety in the table, one giving the percentage occurrence amongst all samples and the other the percentage amongst named varieties only. Only those varieties are included which occur to at least 0·9% of all samples.

Compared with the corresponding figures for the previous season, there is no change of importance in the order of the first few varieties in any group. It is interesting to note that Red Marvel is again amongst the first six varieties in the wheat group.

Table IX. *Shows distribution of cereal samples according to variety.*

	Percentage of total.	Percentage of named varieties.		Percentage of total.	Percentage of named varieties.
		WHEAT.			
Squarehead's Master and Red Standard	15·6	18·4	Renown	1·3	1·6
Little Joss	12·9	15·3	Chevalier	1·1	1·3
Victor	11·2	13·2	Redman	1·1	1·3
Wilhelmina	7·8	9·2	A.1	1·1	1·3
Red Marvel	6·0	7·1	Miller	1·0	1·2
Yeoman and Yeoman II	5·9	6·9	Million III	1·0	1·2
Garton's "60"	3·0	3·5	Drottning	·9	1·1
Squarehead's Master II	2·7	3·1	Other named varieties	10·1	12·0
April Bearded	1·9	2·3	Not named	15·4	
		BARLEY.			
Spratt-Archer	16·6	35·8	Beaven's Plumage	1·0	2·0
Plumage Archer	12·6	27·2	Archer	·9	1·9
Plumage	4·8	10·3	Pembroke	·9	1·9
New Cross	2·5	5·5	Other named varieties	5·6	12·1
Golden Archer	1·5	3·3	Not named	53·6	
		OATS.			
Victory	17·2	21·4	Onward	2·9	3·6
Abundance	7·0	8·7	Yielder	2·5	3·1
Marvellous	6·3	7·8	Golden Rain and Golden Rain II	2·2	2·7
Grey Winter	4·9	6·2	Supreme	1·8	2·2
White	4·2	5·2	Black	1·8	2·2
Black Winter	4·0	5·0	Superb	1·6	2·0
White Winter	3·6	4·5	Other named varieties	10·6	13·1
Black Tartar	3·4	4·2	Not named	19·5	
Black Supreme	3·3	4·1			
Star	3·2	4·0			

SEED-BORNE PLANT DISEASES.

A. Diseases of Cereals.

The routine purity examination of cereal samples includes noting and reporting the presence of certain seed-borne diseases where evidence of infection can be determined by " naked-eye " examination only. Figures showing the percentage of samples with " naked-eye " evidence of infection are given in Table X, together with comparable figures for the season 1935-36. The cereal samples examined would have been derived almost entirely from the harvest of 1936. The percentage of wheat samples found to contain bunted grain is again very low, and the percentage of samples contaminated with " ear-cockles " is lower than in any previous season. Smutted grain was found to be present in barley samples to a less extent than in the two preceding seasons, but the percentage of rye samples containing " ergots " has risen to a figure which has not been exceeded since 1930-31. Where ergot was found to be present in samples, the actual quantity per infected sample was small and in the majority of cases was, by weight, only a " trace ".

Table X. *Shows percentage of cereal samples with " naked-eye " evidence of disease infection.*

	1936-37 per cent.	1935-36 per cent.
Bunt in Wheat—*Tilletia Caries* (DC.) Tul.	**2·7**	2·4
Earcockles in Wheat—*Anguillulina tritici* Gervais and Beneden...	**1·5**	1·6
Ergot in Wheat—*Claviceps purpurea* (Fr.) Tul.	**1·3**	0·6
Smut in Barley—*Ustilago Hordei* (Pers.) Kellerm. and Swing ...	**4·6**	4·9
Ergot in Rye—*Claviceps purpurea* (Fr.) Tul.	**19·3**	8·8

B. Diseases of Celery.

33 samples of celery were submitted for special examination for the presence of *Septoria Apii. Chester* (Celery leaf spot) during the season under review and these samples were also examined for *Phoma apiicola. Kleb* (Phoma root rot). Table XI shows the number and percentage of samples falling within certain limits of infection, as determined from the presence of *pycnidia* upon the " seed ".

Table XI. *Shows number and percentage of celery seed samples infected with Septoria Apii and Phoma apiicola.*

Range of infection per cent.	*Celery Leaf Spot.* Number of samples	No. of samples as percentage	*Phoma Root Rot.* Number of samples	No. of samples as percentage
Nil	6	18·1	18	54·5
1— 5	14	42·4	12	36·4
6—10	3	9·1	2	6·1
11—20	1	3·0	1	3·0
21—30	2	6·1		
31—40	1	3·0		
41—50	2	6·1		
51—60	2	6·1		
61—70	2	6·1		

C. General.

Enquiries were received during the season in connection with various seed-borne plant diseases and a number of samples of various kinds were submitted for examination for the presence of pathogenic organisms. Diseases of economic importance recorded on seed samples during the year, in addition to those mentioned in Tables X and XI, include the following :—

Helminthosporium Avenae — Leaf spot of oats.
Helminthosporium gramineum — Leaf stripe of barley.
Ascochyta Pisi — Pea pod spot.
" Marsh Spot " of peas.
Phoma Betae — on mangold and beet " seed ".
Phoma Lingam — canker of swedes.
Aplanobacter Rathayi — in cocksfoot samples.

In co-operation with Dr. Dillon Weston, the Advisory Mycologist for the Eastern Province, the Seed Testing Station prepared and staged a comprehensive demonstration of seed-borne diseases in connection with the annual conference of Advisory Mycologists, which was held in Cambridge in July 1937. The demonstration was designed to show various phases of a number of seed-borne plant diseases of economic importance, and included a large number of coloured illustrations prepared by Dr. Dillon Weston, seed samples infected with various disease organisms, seedlings and mature plants showing disease symptoms, demonstrations of disease control by seed treatment, especially to show the dangers of faulty technique and an interesting display of general and specific literature dealing with the diseases demonstrated. The Mycologists attending the conference attended a meeting held at the Official Seed Testing Station, at which the above demonstration was discussed.

A similar demonstration was staged and displayed in one of the laboratories of the Station on the occasion of the Fellows' Meeting of the Institute held later in July.

MOISTURE CONTENT OF SEED SAMPLES.

A greater number of samples was submitted for moisture content determination than in any preceding year, the total reaching 290, made up as follows :—

Wheat	103	samples
Barley	3	,,
Peas	3	,,
Sugar Beet ...	174	,,
Mangold	1	,,
Turnip	4	,,
Rape	2	,,

WILD WHITE CLOVER CERTIFICATION SCHEME.

The plots sown down in September 1936, from " head " samples collected from inspected pastures during the summer of that year, numbered twenty-four and they were examined and reported upon in July 1937 by the Plot Inspection Committee set up under the above scheme. Each year the

Station receives samples of clover heads from fields entered and inspected under the scheme and also type samples from pastures which have been finally certified. Plots are sown from all these samples, the total of such plots being 1,022 up to July 1937.

INVESTIGATIONS.

A. Routine investigations.

As mentioned earlier in this report, a total of 2,170 tests of an investigational character were undertaken during the season. These tests were in connection with investigations concerning the longevity of seeds, which go on from year to year, and with problems which presented themselves for solution during the course of the season's work.

B. Special problems.

Work already commenced to determine the effect upon the " keeping quality " of cereals after having been dressed with organic mercury seed dressings, has been continued, and extended to include an investigation into the influence of initial moisture content of the seed and of subsequent storage conditions upon the general effect of such dressings.

The investigations as to the general effect upon the germination of peas, after dusting with organic mercury compounds, have been completed. The studies embraced laboratory, greenhouse, small plot and field scale trials and the results were published by Mr. C. C. Brett, in collaboration with Dr. Dillon Weston and Mr. J. R. Booer, in the Journal of Agricultural Science Vol. XXVII, Part 1, January 1937—Seed Disinfection, III. Experiments on the germination of peas. Seed protection by the use of disinfectant dusts containing mercury.

GENERAL.

A considerable number of plant specimens was received for identification during the season and requests for information concerning the identity of seeds were more numerous than in most previous seasons.

MEETINGS OF THE FELLOWS OF THE INSTITUTE.

SIXTEENTH ANNUAL GENERAL MEETING.

The Sixteenth Annual General Meeting of Fellows of the Institute was held at Cambridge on the 29th July 1937.

Captain D. M. Wills, Chairman of the Council, who presided, submitted the Seventeenth Annual Report of the Council and the accounts for 1935-36, and they were unanimously received.

Mr. W. Gavin, the Fellows' member of Council, whose term of office was due to expire on the 2nd December 1937, was re-elected a Fellows' member of Council with effect from that date.

An amendment of Statute 6 of the Statutes of Fellowship, of which due notice had been given, was approved without a dissentient. As a result of this amendment it will no longer be necessary to hold at least one Special General Meeting, in addition to the Annual General Meeting, in each year. Special General Meetings may be held however at the discretion of the Council of the Institute.

An address—which is printed below—was given by the Chairman on the place of the Sub-Stations in the work of the N.I.A.B. Before giving the address, however, the Chairman referred to the honour which His Majesty the King had bestowed upon the Institute by granting it his patronage. As in previous years the remainder of the meeting was occupied by the inspection of the exhibits in the Official Seed Testing Station and the work in progress on the Headquarters Trial Ground.

THE PLACE OF THE SUB-STATIONS IN THE WORK OF THE N.I.A.B.

Useful though the H.Q. Trial Ground might be by itself, it is obvious that results obtained from one district alone would not carry the same weight as those from a number of trials scattered up and down the country. Climate, soil and altitude are all factors influencing the yield of crops, and it would not be safe to generalise as to the value of different varieties unless their performance were noted, and noted with extreme care, under widely differing conditions. Prior to the cropping year 1924-25 this object was achieved by trials on individual farms at nine centres besides Headquarters, but such a method was found to have various drawbacks, and considerable difficulty was experienced in getting farmers to grow replicated trials. In that year therefore a series of permanent sub-stations was started, the centres chosen being Long Sutton, Leegomery and Sprowston, and in 1925-6 Good Easter and

Newton Abbot were added. The Potato Testing Station at Ormskirk was established in the early days of the Institute's existence.

The present system of sub-stations covers the whole of England south of a line drawn between Lancaster and Scarborough, and thus enables recommendations as to suitable varieties to be given over the bulk of the country. Certain omissions in this respect will be dealt with later.

At this point it may not be out of place to give brief details of the history and situation of the stations.

I have already stated that these were originally as follows :—Sprowston, near Norwich; Long Sutton, Hants; Leegomery, Salop; Good Easter, Essex, and Newton Abbot, Devon, besides the potato station at Ormskirk.

In 1927-28 the Newton Abbot station was moved to Cannington, Somerset, where conditions are much more suitable for trials. At Newton Abbot the soil only represented a small area of actual farming land, and the arable was rather limited, and of uneven fertility, being largely on steep slopes.

In the same year the Leegomery trials were transferred to Newport, Salop, a move which had been intended from the first. The station would indeed have been there originally but for the fact that Dr. Crowther wished first to get the farm in proper order. A more recent change was that from Good Easter to Askham Bryan, Yorks, in the Autumn of 1934, a move dictated by the fact that conditions at the Essex station did not differ sufficiently from those at Headquarters, and Sprowston, and it was evidently more desirable to have one station in the North of England.

Dealing in turn with the present stations. *Sprowston* is at the Norfolk Agricultural Station, which owes its inception to the initiative of local farmers. It stands 100 ft. up, and is a light to gravelly loam, overlying brick earth. Originally under Mr. H. B. Cowell it was taken over by the present recorder, Mr. Rimmer, in 1935. It is of interest to note that the Director of the Station, Mr. Rayns, is also County Agricultural Organizer for Norfolk, and he appears to have achieved the all but impossible task of serving two masters, and yet filling both rôles admirably.

Long Sutton, attached to the Lord Wandsworth Agricultural College, is 476 ft. above sea level, on medium heavy clay, overlying very heavy clay. The first recorder, appointed in 1924, was Mr. C. S. Gibson, and the present one is Mr. A. J. Marval.

Newport, Salop, at an altitude of 210 ft., is under the aegis of Harper-Adams Agricultural College, and on their own land, which varies from a blowing sand to a medium sandy loam, overlying Bunter Sandstone. The recorder, Mr. Maddrell, has been in charge since 1927. A feature of this station is that there is ample ground available, about 40 acres, so that strips are sometimes as much as 230 yards, instead of the more usual 60 yards. This enables a selection to be made for recording purposes of such part of the crop as is really typical, instead of including any that may have suffered local damage, as for instance, by sparrows.

Cannington, Somerset, is situated at from 40 to 70 feet above, and not far from, the Bristol Channel, and is a silty loam, overlying Red Sandstone. The area under trials is 15 acres, but there are only 60 acres of arable on the whole farm, and difficulty has been experienced in finding enough

clean land, free from dropped seed, for trials. The recent purchase of a new field, largely for this reason, will facilitate the work in future. The Farm is that of Somerset County Council, and the recorder, Mr. G. E. Furse, moved there from Newton Abbot with the station.

Askham Bryan, Yorks., is the experimental farm of Leeds University, and the recorder, Mr. Simmons, started work at Good Easter in 1930. The soil here is mainly a medium loam, derived from glacial drift, and overlying Bunter Sandstone. This is not representative of the land in Yorkshire used for barley, or for sugar-beet, so that we have to run an outlying station on the Wolds for the barleys, and one on a sandy loam of good depth for the sugar beet. This arrangement, while not ideal, is the best that can be made.

Ormskirk, the Potato Testing Station, is too well known—both from the work of its Superintendent, Mr. H. Bryan, and that of Dr. Salaman and his fellow experts on the Potato Synonym Committee—to need any particulars from me.

From this summary it will be seen how well varied are the conditions at the several stations.

The reliability of our trials largely depends on the exactitude and care with which the crop-recorders carry out their work, and I should like to express appreciation of this. In some cases they have served us for several years, and the continuity thus obtained is no doubt useful, especially perhaps as regards observation plots.

On the other hand, we cannot hope, or indeed wish, to keep an ambitious man indefinitely in a subsidiary position, and must regard such an appointment as likely to be used as a stepping stone to a more advanced post. I am referring to those whose recording work is a whole-time job, but there is at any rate one instance where valuable help outside it is given by the recorder.

The harmonious way in which the recorders are able to work with those responsible for the management of the farms to which the stations are attached is creditable to both parties. In this connection it should be realised that there is often a conflict of interests, as naturally both farm manager and recorder are anxious to get in their crops at the most favourable time. An individual farmer having trials on his land might not always give them preference at seed time and harvest, but I think it may be claimed that we do not suffer in this respect. Owing to the special nature of trials work, drilling and harvesting take an unusual time, sometimes only 1½ acres being sown in a day, and on at least one sub-station the farm barley has gone in late on account of N.I.A.B. work, while Autumn cleaning has had to be neglected for the same reason. True, the stations are paid for their trouble but it is very satisfactory that they study our interests so well. I have referred to one main object of the sub-stations, but there is another aspect which appears to me to be of almost equal importance; I mean their value for propaganda purposes. Advertising of results, and leaflets distributed by County Organizers may be of considerable help, but how much more convincing must it be to the farmer to see the actual trials in progress. Probably in many cases it has not occurred to him that there is anything beyond the old favourites to which he is accustomed, but here he finds varieties previously unknown, growing side by side with the standard ones, and more than holding their own.

On the other side of the picture it is helpful to be able to see what not to grow, and to note the importance of early seeding. Round Newport, Salop, spring wheat is grown increasingly, after sugar beet, and a larger area is therefore allotted to this crop in trials there than at some other stations. Little Joss is a great favourite with the local farmers, but the station insists that it must not be sown after the end of February. In one late-seeding year this was demonstrated, and proved a good object lesson. This summer, however, Little Joss, drilled in good time, is showing up to much greater advantage than some of the new true spring wheats, such as the Hybrids 27 and 29, and Benoist 40.

Some people, believing in the claims made by the vendors, are too ready to buy a new variety, or one which is merely a synonym of an old one, but if they took the trouble to see some of these growing at a sub-station it would often save them wasted labour and expense. The trials are also useful in demonstrating qualities other than increased yield, as for instance, stiffness of straw, which is tested thoroughly under high farming conditions. Where a sub-station is run in connection with a College, or Farm Institute, it makes a specially wide appeal. Such places are visited by the smaller farmers, who would possibly not think of going to see a trial as such, but are none the less impressed when taken round the N.I.A.B. plots as part of the farm tour. A great and increasing interest is being taken by these men, as I have been able to see for myself at Cannington. Those living near a sub-station have the great advantage of being able to observe the behaviour of a new variety during three or four years prior to its recommendation.

In cases where trials are held at an agricultural station, such as Sprowston, the experiments carried out on behalf of the R.A.S.E. and the Sugar Beet Research and Education Committee provide an added interest to those who go primarily to visit our trials. One of the aims of the Institute is in the direction of co-ordination, and County Organizers are using our trials more and more, instead of making individual, and often unreplicated efforts. These officials feel a real appreciation of our work, which enables them to give recommendations from a dependable and unbiassed source. I myself have benefited in this way, having grown Resistance oats successfully (when I put them in suitable land), as also Eagle oats, Wilhelmina and Juliana wheat, and this year a small plot of Maja barley. As my land will not grow a malting sample, and drilling had to be done late, Maja may produce a better crop of feeding barley than Spratt Archer, although at the moment it does not seem likely. I learn that Norfolk farmers, profiting by results at Sprowston, are tending to grow Onward oats, in place of the varieties previously in favour.

Earlier in this address I mentioned that there were certain omissions in the provision of sub-stations to suit all areas, and perhaps the best instances are Wales and the Fens. For some years the establishment of one in Wales has been contemplated, and negotiations are even now taking place with the Ministry of Agriculture in order that co-operation with Aberystwith, which is much desired, both by Professor Stapledon and ourselves, may be effective. In the Fens isolated trials have been conducted during the past few years, but owing to lack of adequate supervision they have not always been satisfactory.

The main difficulty in the way of these extensions is a financial one, as the cost would probably be in the region of £2,000 a year.

The establishment of a Welsh station might lead to the discovery of varieties suited to the poorer land, in England as well as Wales, though Prof. Stapledon's oat, S.84, has not proved very successful in S.W. England. After visiting the plots for several years one is rather inclined to feel that the bulk of the work done has been on behalf of those farming good land. It would be of great assistance to farmers on poorer soils, and in late, hilly districts if the Institute could recommend an oat of early-ripening quality, with good feeding straw, and an increased yield of, say, 5%.

In conclusion, as Sir Daniel Hall said last year, the prime object of the Institute is to promote the interests of farmers, and I submit that not the least important function of the sub-station is to act as a link between the Institute and the practical farmer.

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CONTENTS.

FOREWORD.

The present number of the Journal contains a report which marks the conclusion of two further " full " three-year trials of certain strains of Sugar Beet in different parts of this country. These together constitute the fourth of these three-year series since work on Sugar Beet was started in 1927, and, with the publication of these results, it can be stated that information is now available relating to any of the strains of Sugar Beet which are likely to be met with in this country. Sugar Beet strains are not stable in constitution, so that further trials will always be necessary and are in fact being carried out, together with additional trials relating to still more recent introductions and to the requirements of special localities.

The report of the Official Seed Testing Station is now a regular feature of this Journal and it is interesting to note the large increase in the number of samples handled which has taken place in the last two years. The report of the Potato Synonym Committee — also a regular feature — is of special interest in marking the very great progress which has been made towards the elimination of synonyms. These have now disappeared almost completely from the lists of the larger firms; much, however, still requires to be done to complete the elimination of such types from the lists of local seedsmen. Of the new " distinct " varieties submitted for test in the present year, none were found to be susceptible to Wart Disease and it would appear that, in future, we may expect to find only immune types put forward. These and other points relating to the Potato Crop are referred to also in the Chairman's address to the Seventeenth Annual General Meeting of the Fellows of the Institute. In this address, which will be found in the printed account of the meeting, Dr. Salaman has summed up the progress which has been made in potato breeding and testing in the last twenty years and has indicated that a stage has now been reached when further real progress cannot be expected unless a fresh start is made along entirely new lines.

A report of trials made on Chicory strains in the years 1936-38 is included in this number, thereby breaking fresh ground. Prior to the carrying out of these trials, it would appear that authoritative information as to the strains of chicory suitable for growing in this country was entirely lacking.

Finally, reference must be made to the report by the Research Association of British Flour Millers on samples of wheats drawn from certain of the N.I.A.B. trials harvested in 1938. The bulk of this report refers to certain wheats grown under high farming conditions and indicates, though not as clearly as would have been expected, the general superiority in baking characters of Yeoman II over the other kinds included in the test. On the other hand, the general level of performance was disappointing and it was found that the bread-making behaviour of types which had shown quite satisfactory dough making properties was not up to expectation and was influenced to a surprisingly slight extent by wide variations in the fermenting process. This peculiarity in the results gave rise to further investigations in

the course of which certain commonly used flour improvers were added. As a result, very marked improvements in all bread characters were obtained, the improvement being roughly proportional both to the protein content and to superiority in dough-handling.

It would appear from this that, in future, it will definitely be necessary to extend the baking tests to include trials in which such flour-improvers are added as are habitually employed by flour millers in this country. Without this additional information it is not possible to obtain a true picture of the bread-making potentialities of the wheats submitted for test.

The Institute wishes to express its thanks for the funds provided through the Sugar Beet Research and Education Committee of the Sugar Commission to cover the cost of the trials of strains of sugar beet, and its gratitude to Chicory Ltd., St. Ives, Hunts., whose co-operation and financial assistance made possible the Chicory trials report on pp. 360, and to Messrs. J. Lyons & Co. Ltd. for making the necessary roasting tests : to Dr. Fisher, Director of the Research Association of British Flour Millers for his report on the quality for breadmaking purposes of wheats harvested in 1938 and to Mr. C. J. Mapey for valuing oat samples obtained from the trials.

The trials at the Institute's Headquarters Trial Grounds, Cambridge, the Potato Testing Station, Ormskirk, and the five Sub-stations are supervised as follows :—

Cambridge :	by Mr. S. F. Armstrong, Manager of Field Plots, assisted by Mr. E. G. Thompson, Mr. B. Brandreth and Mr. T. W. Stops.
Ormskirk :	by Mr. H. Bryan, Superintendent of Potato Trials, assisted by Mrs. McDermott.
Cannington :	by Mr. G. E. Furse, Crop Recorder.
Long Sutton :	by Mr. A. J. Marval, Crop Recorder.
Newport :	by Mr. H. E. F. Maddrell, Crop Recorder.
Sprowston :	by Mr. P. J. Jones, Crop Recorder.
Askham Bryan :	by Mr. H. W. Simmons, Crop Recorder.

(*Signed*) M. A. BAILEY.

June, 1939.

TRIALS OF SUGAR BEET STRAINS, 1936-1938.

S. F. ARMSTRONG, M.A.

CONTENTS.

INTRODUCTION.

The Institute's sugar beet trials over the period 1936-1938 were divided into two groups : (a) the *main trials* which were planned to include only continental strains and to be sown with continental-grown seed ; and (b) *supplementary trials* in which only English-grown seed of certain continental and English raised strains was used. In both groups the German-grown Kleinwanzleben E strain was used as the control.

The selection of strains for the present trials was based upon their behaviour either in field observation plots or trials during previous years.

I.—MAIN TRIALS.

The strains included were :—Braune E, Buszczynski N.P., Dobrovice V.E., Erhard Frederiksen's (or Eagle Hill) No. 120, Erhard Frederiksen's (or Eagle Hill) No. 472, Mette S.P., Rimpau Z, Schreiber S.K.W., and Kleinwanzleben E (control).

Two changes in the strains tested occurred in the course of these trials ; (1) the strain Mette S.P. was not continued after 1937 as the firm failed to supply seed and also informed the Institute that it did not wish for further trials to be made ; (2) a supply of English-grown seed of Buszczynski N.P. became available in 1937, and this was added to the main trials rather than the supplementary trials so that a more direct comparison might be possible with the foreign-grown seed of the same strain.

SOURCE OF SEED SUPPLY.

Except for the English-grown Buszczynski N.P. all the seed used was grown on the Continent. As far as possible the seed was obtained from factory sources, but in 1936 the seed of Rimpau Z and Dobrovice V.E. came direct from the breeders, while seed of Mette S.P. and Buszczynski N.P. (Polish) came direct from the breeders in each year.

THE TRIAL STATIONS.

The main trials were situated in beet-growing areas at the following five centres :—

1. Somerset Farm Institute, Cannington, near Bridgwater.

The trials were situated on silty loam soil overlying Red Marl sub-soil and between 40 and 60 feet above sea level.

2. Harper Adams Agricultural College, Newport, Shropshire.

In each year the crop was grown on a sandy loam soil overlying Bunter Sandstone at an altitude of rather more than 200 feet.

3. Norfolk Agricultural Station, Sprowston.

The soils were free working loams overlying Brick Earth and about 90 feet above sea level.

4. Harswell, near Market Weighton, East Yorkshire (under control of the Askham Bryan Sub-station).

In each year the trials were on a light sandy loam with rather heavier sub-soil, and about 20 feet above sea level.

5. Selby (in co-operation with the British Sugar Corporation Ltd).

The soils here were medium loams with a rather high sand content, and the altitude was approximately 20 feet.

CLIMATIC CONDITIONS. (Tables I - II).

The three seasons differed very much in character and none of them was very favourable for beet cultivation; the sowing periods especially were unfavourable.

In 1936, during the normal sowing period in April, the weather was exceptionally cold, and in May it was also cold and unusually dry. As a result germination was slow and irregular so that the " setting out " and singling operations were retarded. Finally, however, satisfactory " plants " were obtained at all centres. June and July were definitely wet months, and the heavy rains combined with lack of sunshine were unfavourable to the crops, especially at Cannington, Harswell and Selby. The season favoured high tonnage rather than high sugar contents.

Climatic conditions varied somewhat at the different centres in 1937. At Cannington the rainfall was abnormally high from January until March. The weather then became more normal until June when a drought occurred which continued until the middle of July. Afterwards the weather was more favourable.

At Newport January, February and July were wet months, while August was rather dry. Sunshine was very deficient during June and July.

At Sprowston there was excessive rainfall from January until May. Sunshine was below normal excepting the months of August and September.

At Harswell and Selby the rainfall was abnormally high for the first five months of the year. From May until the last week in October rainfall was deficient and crops were checked by drought during August and September.

As a result of the excessive rainfall during the first four months of the year sowings were delayed and the crops made a rather late start. Growth was further checked by dry conditions for considerable periods in the summer

months at each centre except Newport. A notable feature of the 1937 summer was the general deficiency of sunshine.

In 1938 there was a marked deficiency of rainfall at all centres during February, March and April. Throughout the last-named month there was a drought which continued until the 17th of May at Sprowston, Harswell and Selby, and until the 26th of May at Cannington and Newport. There were also numerous rather severe night frosts during April. The extremely dry conditions during spring proved a serious handicap in the preparation of seed beds; germination was slow or irregular, and the crops were generally late in growing away. This general lateness was accentuated by the fact that the greater portion of the season's rain fell towards the end of the beet growing period. The combination of spring drought with ample autumn rainfall largely explains why the sugar contents were so low in spite of the fact that the root weights were also poor. The roots had a shortened period for active growth and were less mature than usual when lifted.

GENERAL CONDITIONS OF CULTIVATION.

Each of the trials followed a cereal crop. In all cases a complete and liberal dressing of fertilisers was applied to the seed beds, and (except at Harswell and for the two last seasons at Selby) dung was also applied in the previous autumns. Where dung was not directly applied to the beet crop there had been an application either of dung or of shoddy to the previous crop. At Selby in 1937, however, where the land was of a lighter character, there had been no recent application of dung and this omission was partly responsible for the light crop. Drilling was done " on the flat " except at Newport and Harswell where slight ridges were made. The rows were spaced 18 inches apart at Sprowston and at Cannington in 1936 and 1937; in all the other trials the spacing was 20 inches. The seed was dusted with an efficient seed dressing and sown at rates approximating to 20 lbs. per acre. The sowing and lifting dates were as follows :—

1936	Cannington	Newport	Sprowston	Harswell	Selby
Sowing dates ...	1st May	5th May	18th Apr.	4th May	22nd Apr.
Lifting periods ...	24th-26th Oct.	22nd Oct-1st Nov.	6th-17th Nov.	15th Oct.	28th-30th Oct.
1937					
Sowing dates	4th May	11th May	24th Apr.	5th May	3rd May
Lifting periods ...	15th-22nd Nov.	26th Oct.-6th Nov.	10th-30th Nov.	2nd-3rd Nov.	23rd-25th Oct.
1938					
Sowing dates ...	9th May	4th May	21st Apr.	28th Apr.	20th May
Lifting periods ...	8th-16th Nov.	7th-12th Nov.	4th-11th Nov.	19th Oct.	7th-11th Nov.

In 1936 both sowing and lifting were done at normal dates. Plant establishment was rather reduced by wireworms at both Sprowston and Selby, but no pests or diseases affected the later growth of the crops anywhere.

In 1937, in spite of the wet spring, the sowing dates were not unduly late. At Cannington the crop growth was checked during June and early July by drought, and at the same time a severe attack of Black Aphis (*Aphis fabae*, Scop.) also occurred. A deluge of rain (3·46 inches in ten hours on the 15th July helped the crop to recover, but the beet foliage yellowed off much earlier than usual at that centre, and the yields were undoubtedly reduced by the damage caused by both Aphis and drought. Aphis attack was also rather severe at Sprowston during July, where also drought in August and September caused much wilting and premature leaf fall. At Selby Aphis attack caused serious damage during June and July, and the small topped strains appeared to suffer most. At Newport and Harswell Aphis attack was not serious, but at the latter centre the crop was checked by drought during August and September.

In 1938, in spite of exceptionally dry conditions, the only very late sowing was at Selby, where a satisfactory seed bed could not be prepared before the 20th May. Germination was slower than usual at all centres, and brairding was also irregular, especially at Harswell.

Spacing and singling were not possible until the middle of June at Cannington and Newport, while the latter operation was not completed until July at Harswell. At Sprowston the crop was more advanced than at the other centres, and singling was completed by the 1st June. Unfortunately the advantages of this earlier growth at Sprowston were completely lost from other causes. A very severe attack of Aphis occurred during June and July. On the 2nd July, during a thunderstorm, a heavy fall of large hailstones cut the leaves of the beet badly. Although on the same date heavy rain washed many of the Aphides from the crop the combined damage from Aphis and hail proved a serious check to growth. The crop at Sprowston never fully recovered from the damage done and this is reflected in the poor yields obtained at that Station. At the other centres, the crops, after a tardy start in June, grew unchecked until the end of the season.

TRIAL METHODS USED.

Each strain was grown in plots repeated eight times in as many randomized blocks. Each plot consisted of four rows, the two outer rows of which served as "buffer rows" between the strains and were discarded at lifting time. The root yield of each plot was obtained from the inner rows only and included an area of 1/80th acre. The total combined area of the eight plots of each strain was therefore 1/10th acre. The only departures from this standard area in the course of these trials were at Cannington in 1936 where, owing to lack of space, the area of each strain was slightly reduced to ·09 acre; and at Selby in 1938 where two of the replicated blocks had a deficient "plant" and were discarded, reducing the area under each strain to ·075 acre.

The Institute's standard methods of root sampling and analysis were followed as in previous years. Each strain was sampled by drawing at random twelve roots from each plot; six of these roots were placed in "sample A" and six in "sample B", so that the duplicate samples of every strain included 48 roots each. The estimation of the sugar content of the roots was done by the cold water digestion method.

All the cultural operations, notetaking, sampling, weighing, etc. were in charge of a resident Crop Recorder. The root yields taken were the yields of carefully topped and washed beet. The standard errors were very low at both Cannington and Newport in 1936 and 1938, and reasonably low in the rest of the trials with the exception of those at Harswell in 1936 and 1937, and at Selby in 1936. The significant difference in root yield for each trial is given in Table VI expressed as a percentage of the control. The results of the three years' trials separately stated, and the general averages, are given in Tables III - VIII as a percentage of Kleinwanzleben E.

BOLTING.

The percentages of plants bolting in each season, and the general average percentage, are shown in Table III. Over the whole period the least bolting occurred at Cannington and the most at Sprowston. The higher rate of bolting at Sprowston is probably due to the earlier dates of sowing at that centre. In 1938 there was more bolting than in the two previous years except at the two Yorkshire centres. Mette and Rimpau showed the greatest propensity to bolt, and in these two strains this tendency was obviously sufficient to detract from their cultivation value. Schreiber and Braune each produced 2 per cent. or more of bolters in four trials, though on the whole their bolting tendency was moderate. The remaining strains were more satisfactory in this character, the most resistant to bolting being Erhard Frederiksen's No. 472 and Kleinwanzleben E.

SIZE OF TOPS.

Dobrovice produced by far the largest tops and they were always very erect. Those of Mette, Rimpau, Braune and Schreiber were also decidedly large and erect. Buszczynski (both Polish and English-grown) and Kleinwanzleben E produced moderately large erect tops, while the two Erhard Frederiksen's strains each had tops of medium-small size.

PLANT POPULATIONS. (Table IV).

The populations were good, except at Sprowston and Selby in 1936 and at Cannington in 1938. At the last named centre two causes were responsible for the low populations, (1) the wider row spacing used in 1938 (20 inches), and (2) an attack of cutworms (*Euxoa* sp.) which killed many young plants after singling time. At both Selby and Sprowston in 1936 wireworms reduced the " plant ", and at the latter centre there was also some loss through attack of the mangold fly (*Pegomyia hyoscyami*).

The least variation in population between the strains was at Cannington. At the other centres occasional differences of more than 10 per cent. from the control occurred, but except in two instances (Dobrovice at Newport in 1937, and at Harswell in 1938) these larger population differences were advantageous to the strain under test rather than to the control. Taking the general average population over the fifteen trials no strain had a population lower than 98 per cent. or larger than 104 per cent. of the control.

ROOT WEIGHT AND SHAPE. (Table V).

None of the strains approached closely to the control in average root weight. Erhard Frederiksen's No. 120, the next in order of weight, had roots on an average some 6 per cent. lighter. The smallest roots were produced by Rimpau. The lowest root weights at any centre were at Sprowston in 1938, and reflect the damage caused by drought and Aphis attack previously mentioned.

The constancy of Kleinwanzleben E in giving a high root weight was again confirmed. Its general average root weight over the series of trials now completed was :—1936-38=1·07 lb., 1933-1935=1·06 lb., 1930-1932=1·19 lb., 1927-1929=1·10 lb.

A considerable tendency to fanginess was evident in most of the strains throughout these trials. This appears to have been largely due to the unfavourable seasonal conditions which frequently checked normal growth. A careful comparison of the roots at the time of lifting and washing led to the conclusion that the lowest proportion of fanged roots were present in the two Erhard Frederiksen's strains, Kleinwanzleben E and Braune. Both the Erhard Frederiksen's strains had roots of a short wedge shaped type, broad at the shoulder. Dobrovice also had roots of a similar shape but were rather more shallow rooted. The other strains are less easy to describe, but Kleinwanzleben E, Braune and Schreiber had noticeably long deep seated roots.

YIELD OF ROOTS. (Table VI).

The control strain, Kleinwanzleben E, gave a general average yield of 13·04 tons of washed beet per acre, the highest of any strain. It was only outyielded by other strains on four occasions and never to a significant extent.

Erhard Frederiksen's No. 120 was outyielded to a significant extent by the control in four trials out of fifteen. There was no significant yield difference in the remaining eleven trials, and the average yield of this strain was 95·2 per cent. of the control. It gave relatively lower yields at Cannington than at other centres.

Erhard Frederiksen's No. 472 in eight trials out of fifteen was significantly outyielded by the control, and gave an average yield equal to 93·8 per cent. of the control. It gave relatively higher yields at Newport and Selby than elsewhere.

Braune E gave significantly lower yields than the control in seven out of fifteen trials, and an average yield equal to 93·3 per cent. of the control.

Buszczynski N.P. (Polish) was outyielded by the control in nine of the fifteen trials. It gave an average yield equal to 91·9 per cent. of the control. Its average root yield was identical with that of English-grown Buszczynski N.P. over the two seasons in which they were grown together.

Schreiber S.K.W. was outyielded significantly by the control in nine out of fifteen trials. Its average root yield was 91·5 per cent. of the control.

Dobrovice V.E. The average yield of this strain was almost ten per cent. below the control. It gave significantly lower yields than the control in eleven out of fifteen trials.

Mette S.P. This gave significantly lower yields than the control in eight out of ten trials, and an average yield equal only to 89·8 per cent. of the control.

Rimpau Z was outyielded by the control to a significant extent in no less than thirteen trials out of fifteen. Its average yield was only 85·6 per cent. of the control.

SUGAR CONTENT OF ROOTS. (Table VII).

None of the seasons was favourable for high sugar contents and the year 1938 was particularly bad in this respect. In each season the sugar contents were comparatively low at Cannington. A comparison with previous three year periods shows that Kleinwanzleben E had a lower general average percentage of sugar over 1936-1938 than in any previous period. The figures were :—1936-1938=16·26 per cent., 1933-1935=16·82 per cent., 1930-1932=17·01 per cent., 1927-1929=17·30 per cent. As usual, Kleinwanzleben E had the lowest average sugar content associated with the highest average root weight.

Rimpau Z was outstandingly good for its sugar contents and is evidently correctly described as belonging to the "Z" type. Others with relatively good sugar contents were Braune E, Dobrovice V.E., Buszczynski N.P. and Mette S.P. The remaining three strains did not differ materially from one another, and each had a rather higher average sugar content than the control.

YIELD OF SUGAR. (Table VIII).

Kleinwanzleben E gave the highest general average yield of sugar, viz. 2.13 tons per acre. On the average the two Erhard Frederiksen's strains and Braune E gave relatively high yields of sugar, while Rimpau and Mette gave decidedly poorer yields than the others.

COMPARATIVE CASH VALUE OF THE STRAINS. (Table X).

This has been calculated by taking (a) the yield of washed beet, (b) the sugar content, and (c) a theoretical price per ton paid at the factory. The actual basic price paid for beet varied each year and differed slightly between factories; further, the basic price for the 1939 crop has been raised considerably and will be 46/3d. per ton at some factories and as high as 48/3d. at others. As the object of the present comparison is to show the relative value of the strains under the latest conditions (and on a common scale of values) they have been compared in Table X, (a) on a basic price of 46/- per ton and (b) on a basic price of 48/- per ton for beets having a sugar content of 15·5 per cent. The usual rate of 2/6d. per ton for each one per cent. above or below 15·5 per cent. has been allowed. The general average value per acre of each strain is given in Table X, and the different values are also shown as a percentage of Kleinwanzleben E.

II. SUPPLEMENTARY TRIALS.

Eight other strains of sugar beet were tested in additional trials over the period 1936-1938. These additional trials were conducted to test the behaviour, and assess the comparative value, of English-grown seed of certain well-known continental strains, and also of some other strains produced by English seed firms. The strains were Kleinwanzleben E (Sharpe's English-

grown), Marsters' British Hilleshog, Johnson's Perfection, Dippe E (Battle's English), Webb's No. 2, Gartons' B (formerly known as Kuhn type), Carter's No. 3, and Cannell's No. 937. All the seed used was English-grown, except that—as in the main trials—German-grown seed of Kleinwanzleben E was used as the control. The seed was obtained from factory sources excepting Carter's No. 3 which came direct from Messrs. James Carter & Co., Raynes Park, London. Owing to lack of land four of the strains were omitted from the Cannington trial in 1936 (see Table XI), and the area occupied by each of the remaining strains was reduced from ·1 acre to ·09 acre. Except on that occasion no changes were made during the course of these trials at any centre, and the areas sown and the number of replications were the same as those employed in the main trials.

These supplementary trials were at the same centres (excepting Selby) as the main trials already described. Actually, with the one exception noted below, they were always adjacent to the main trials, and not only the soil conditions, but the manuring and general cultural treatments were the same as those in the main trials. The methods of trial followed were also precisely the same. Reference should be made to the main trials for such details and for the climatic conditions prevailing.

The one exception where these trials were grown apart from the main trials was at Newport in 1937; the soil was a rather light sand, overlying Bunter Sandstone at an elevation of 230 feet; the crop received a complete dressing of artificials in addition to farmyard manure.

The sowing dates of the supplementary trials were as follows :—

	1936	1937	1938
Cannington ...	2nd May	5th May	9th May
Newport ...	13th May	27th April	3rd May
Sprowston ...	11th April	27th April	21st April
Harswell ...	4th May	5th May	28th April

PESTS, DISEASES, ETC.

There were no serious attacks of pests or diseases in 1936.

In 1937 the growth of the crops was affected by the abnormal weather conditions and by Aphis attacks in the same manner as described under the main trials. There was no serious disease.

In 1938, at Sprowston, the growth was seriously checked by drought and Aphis attack, and also by hail damage on the 2nd July; but at the other Stations, after a rather slow start, growth was unchecked until the lifting period. At Cannington, however, an attack of cutworms reduced the plant populations.

The plots were lifted on the following dates :—

	1936	1937.	1938
Cannington	2nd-5th November	22nd-29th November	16th-22nd November
Newport	29th Oct.—7th Nov.	19th-20th October	11th-17th November
Sprowston	19th-21st November	2nd-8th December	21st-23rd November
Harswell	18th-20th November	29th-30th November	17th-18th November

FIELD BEHAVIOUR OF THE STRAINS.

Bolting (Table XI) was most in evidence at Sprowston, but even there it was only serious in 1936 and 1938. Outstanding in its resistance to bolting, even under the more favourable conditions at Sprowston, was Marsters' British Hilleshog. Except for occasional lapses all the other strains behaved in a fairly satisfactory manner as regards bolting, though Battle's English Dippe and Carter's No. 3 generally showed a greater tendency to bolt than the others.

The size of the tops were in the following order :—

Battle's Dippe E	Large, erect.
Kleinwanzleben E (control) Kleinwanzleben E (English-grown) Cannell's No. 937	Rather large and erect.
Gartons' B Webb's No. 2	Medium-large.
Johnson's Perfection Marsters' British Hilleshog	Medium.

The tops of Cannell's No. 937 were larger in 1937 and 1938 than in the previous seasons.

The proportion of fanged roots was rather large in each year, except on the sandy soil at Newport in 1937. The strains which on the whole had the fewest fangs and the most constant root shape were Marsters' British Hilleshog, Cannell's, Johnson's Perfection, Kleinwanzleben E (German and English), and Webbs.

PLANT POPULATIONS. (Table XII).

The plant populations were good in all these trials with the single exception of that at Cannington in 1938, where an attack of cutworms reduced the " plant ". Two rather wide differences from the control population occurred at Newport, where in 1936 Webb's No. 2 had a population 10 per cent. lower, and in 1937 when the same strain had a population 11 per cent. above that of the control. Elsewhere the differences between the control and the strains under test were not considerable and only exceeded 5 per cent. on two occasions. On an average of all the trials the population difference between any strain and the control in no case exceeded one per cent.

INDIVIDUAL ROOT WEIGHT. (Table XIII).

Except at Sprowston in 1938 the individual root weights were good in all the trials. The general average root weight of Kleinwanzleben E was 1·146 lb. — the highest of any strain. The English-grown Kleinwanzleben E gave an almost identical root weight, while Cannell's No. 937 also approached closely to that figure. The other strains had lower root weights ranging from about 90 per cent. to 95 per cent. of the control weight, excepting Marsters' British Hilleshog which had an average root weight only equal to 87·1 per cent. of the control.

YIELD OF ROOTS. (Table XIV).

The German Kleinwanzleben E (control) gave a general average yield of 14·13 tons of beet per acre. In eleven trials the English-grown Kleinwanzleben E gave a higher yield than the control on four occasions—once significantly higher; its average general yield was very slightly above that of the control.

Cannell's No. 937 gave higher yields than the control in six trials out of twelve—one of these differences being significant; on three occasions it gave significantly lower yields. Its general average yields was very nearly equal to the control.

Battle's Dippe E in eleven trials gave either an equal or better yield than the control on three occasions. It was significantly outyielded by the control in three trials, and gave an average yield equal to 95·8 per cent. of the control.

Johnson's Perfection gave a yield equal to the control on one occasion in eleven trials, but was significantly outyielded on five occasions. Its average yield was equal to 92·7 per cent. of the control.

Carter's No. 3 was significantly outyielded by the control in seven trials out of twelve, and gave an average yield equal to 92·7 per cent. of the control.

Gartons' B gave significantly lower yields than the control in eight trials out of twelve. Its average yield was equal to 90·7 per cent. of the control.

Webb's No. 2 was significantly outyielded by the control in seven trials out of twelve, and gave an average yield equal to 90·2 per cent. of the control.

Marsters' British Hilleshog was outyielded to a significant extent by the control in ten out of eleven trials. Its general average yield was only equal to 87·1 per cent. of the control.

The standard errors were reasonably low in all the trials excepting those at Harswell in 1936 and 1937, and at Cannington in the latter year.

SUGAR CONTENT OF ROOTS. (Table XV).

The general average sugar content of the control over the three seasons was 16·43 per cent., which compares with 16·26 per cent. in the main trials over the same period. English-grown Kleinwanzleben E had a slightly lower average sugar content, as had also Battle's Dippe E and Carter's No. 3, while Cannell's No. 937 had a slightly higher sugar content.

Gartons' B, Johnson's Perfection and Webb's No. 2 each had a decidedly higher sugar content than the control, while Marsters' British Hilleshog was outstanding in having roots richest in sugar.

YIELD OF SUGAR. (Table XVI).

The control gave the high general average yield of 2·34 tons of sugar per acre, and similar yields were given by English-grown Kleinwanzleben E and Cannell's No. 937. The other strains gave yields of sugar ranging from 4·5 to 8·2 per cent. less than the control.

VALUE OF THE CROP.

The cash value per acre of the different strains is shown in Table XVIII calculated on the same basis as for the main trials (see p. 359).

Cannell's No. 937 and English Kleinwanzleben E approached very closely to the control in value per acre. The value of the other strains was roughly from 7 - 8 per cent. lower than the control, excepting Marsters' British Hilleshog which had a value 10·5 per cent. lower.

SUMMARY AND REVIEW OF THE STRAINS.

The seasons of 1937 and 1938 were both very unfavourable to the crop, the former owing to excessive rainfall in the early months of the year, and the latter owing to drought over the same period. Even 1936 was not a good season for sugar beet. The only pest attacks that seriously depressed the yields were Aphis attacks on the trials at Cannington in 1937 and at Sprowston in 1938. In every trial each strain was replicated eight times and all the plots were bordered by rows to prevent interference from neighbouring plots. In all but six of the twenty-seven trials the standard errors were small. The general average results are given in Tables IX and XVII.

Kleinwanzleben E (German seed), the control strain, and *Sharpe's English-grown Kleinwanzleben E* consistently gave results so similar that the two may be regarded as identical for commercial purposes. There was never a significant difference between the two in root yield, nor any obvious difference in their field behaviour. This is in complete agreement with the results obtained at four centres in 1930.

This strain maintained the same high standard of previous years and again proved its suitability as a stable control. It gave the highest root yield and also the highest yield of sugar in spite of the fact that its sugar content was slightly lower than most other strains. It produced heavy well-shaped roots and had few bolters. Some reduction in the size of its tops was observed during the last two years but they are still moderately large.

Cannell's No. 937. Of the new strains tested this gave the most outstanding results, and was the only one to compare well with the control on all points. Its average yield of sugar was almost identical with the control, and its quality—as indicated by its comparative sugar yield—appears to have steadily improved during the period under review. Some change in the size of its tops was observed; previous to 1937 they were medium-small in size, but in the last two seasons, and particularly in 1938, the tops were definitely large. Its roots were of good uniform shape, relatively free from fangs, and had a satisfactory sugar content. It never bolted to a serious extent.

Of the other English-grown strains tested all but one (Marsters' Hilleshog) fall into a single fairly narrow group as regards their average yield of sugar which ranged from 92·2 per cent. to 95·5 per cent. of the control. These strains were :—

Johnson's Perfection. This invariably had a higher sugar content than the control but also a lower root weight, and its average yield of sugar was 4·5 per cent. lower. Relative to the control, however, this strain has given better results both in respect of yield of roots and yield of sugar than in the 1933-35 trials. It also continued to show a high degree of resistance

to bolting and had roots of uniform shape. Its tops remain of medium size.

Buszczynski N.P. (English). This had a higher sugar content than the control but, with a lower root weight, gave a yield of sugar some 5 per cent. lower. It had rather large erect tops and on the whole showed a satisfactory resistance to bolting. Its behaviour was in all respects similar to that of Polish-grown Buszczynski N.P. (see Table XIX).

Dippe E (Battle's English). This had a slightly lower sugar content and also a lower root weight than the control; its average sugar yield was about 5 per cent. lower. On two or three occasions it showed a decided tendency to bolt and does not appear suitable for early sowing. It had large erect tops.

Gartons' B. On an average this had a decidedly higher sugar content than the control but a lower root weight. Its yield of sugar was some 6 per cent. less. It had medium-large tops, roots of a satisfactory shape, and generally showed a good degree of resistance to bolting.

Webb's No. 2 also combined a higher sugar content than the control with a lower root weight, and its yield of sugar was 7·5 per cent. lower. It had roots of satisfactory shape, very uniform tops of medium-large size and showed high resistance to bolting.

Carter's No. 3 had a slightly lower sugar content than the control, and with a lower root weight yielded about 8 per cent. less sugar. It had rather large erect tops and, except on two occasions, showed a satisfactory resistance to bolting.

Marsters' British Hilleshog had the highest average sugar content of any strain. Its average yield of roots, however, was low and its yield of sugar was below that of any other English-grown strain. It was the most resistant to bolting, and its roots were of a good uniform shape and usually free from fangs. In the field its appearance was not quite so distinct as formerly since there has been a decided increase in the size of its tops, which are now of medium size.

The results from this strain, though disappointing, are in fairly close agreement with those obtained in the Institute's trials of 1927-1929. It should, however, be noted that in the Institute's trials on good fen land during 1930-32 this strain gave a yield of sugar equal to Kleinwanzleben E and higher than the other strains tested. It is for these richer types of soil that it is recommended.

Erhard Frederiksen's (or Eagle Hill) No. 120. This strain combined a fairly good root weight with a rather higher sugar content than the control and yielded only some 3 per cent. less sugar. Its roots were constant in shape and it showed good resistance to bolting. Its tops were of medium-small size and very uniform.

Erhard Frederiksen's (or Eagle Hill) No. 472. This had a similar sugar content to Eagle Hill No. 120, but gave a slightly lower yield of roots and yield of sugar. On the other hand its root shape was even more constant and its tops—of medium-small size—were very uniform. Its resistance to bolting was better than any other strain with the exception of Marsters' Hilleshog.

Braune E combined a fairly good root weight with a higher sugar content than the control and produced only 4 per cent. less sugar. It had a satisfactory root shape, large erect tops, and showed only a moderate tendency to bolt.

Dobrovice V.E. This gave nearly 10 per cent. less weight of roots but, with a higher sugar content than the control, only some 7 per cent. less sugar. The shape of its roots varied considerably. It produced very large tops—the largest of any strain, and showed only a moderate degree of bolting.

Schreiber S.K.W. had a satisfactory sugar content—rather higher than the control, and usually had a satisfactory root shape. Its sugar yield was about 7 per cent. below the control. It had distinctly large erect tops and usually showed a tendency to bolt above the average.

Mette S.P. and Rimpau Z both gave unsatisfactory results. Mette was in the 1936 and 1937 trials only and was one of the poorest strains. It had roots of satisfactory shape and good sugar content, but its root yield and yield of sugar were low and it showed a distinct tendency to bolt. Its tops were similar in size to the control. Rimpau Z had a high sugar content but its low root yield brought its yield of sugar to below 90 per cent. of the control. Its root shape was not very uniform and more than an average quantity of fanged roots were often present. It showed a higher bolting tendency than any other strain. It had large tops.

Table I.

MONTHLY RAINFALL AT THE TRIAL STATIONS—IN INCHES—SEASONS 1936-38.

Month.	Cannington.			Newport.			Sprowston.			Harswell and Selby,* Yorkshire.		
	1936	1937	1938	1936	1937	1938	1936	1937	1938	1936	1937	1938
January	3·45	4·61	3·10	3·00	†	2·13	2·66	3·44	2·17	2·97	2·78	2·32
February	2·21	4·47	0·89	1·83	3·49	0·54	2·47	2·72	0·86	2·10	3·10	1·17
March	2·66	4·18	0·14	2·05	1·82	0·46	0·46	2·69	0·42	1·09	2·22	0·27
April	2·00	2·33	0·19	1·45	1·98	0·10	1·31	2·33	0·52	1·44	2·98	0·08
May	1·62	1·75	1·99	0·91	2·84	1·44	0·65	3·59	1·86	1·40	3·36	3·43
June	4·01	0·59	1·43	4·09	1·17	1·58	3·10	1·10	0·94	3·58	1·61	2·18
July	4·97	4·90	2·62	4·43	3·01	2·49	3·77	1·98	2·75	2·95	2·17	2·47
August	0·38	1·12	3·57	0·90	0·99	2·98	1·64	1·08	1·18	1·37	1·70	2·69
September	4·56	4·26	3·69	3·31	2·27	1·46	2·64	1·88	2·31	1·88	0·96	2·06
October	1·65	3·47	2·69	1·41	2·60	3·14	1·96	2·68	2·92	1·48	2·46	3·32
November	3·16	2·18	3·51	2·62	1·47	2·94	2·88	2·33	2·16	2·76	1·91	2·63
December	2·27	2·32	3·68	2·07	2·99	2·75	1·49	3·25	3·66	1·14	2·00	3·68
Total for year ...	32·94	36·18	27·50	28·07	24·63‡	22·01	25·03	29·07	21·75	24·16	27·25	26·30
Total March - Oct. ...	21·85	22·60	16·32	18·55	16·68	13·65	15·53	17·33	12·90	15·19	17·46	16·50

* The records given under the two Yorkshire centres were taken at Askham Bryan, near York.
† Figure unreliable.
‡ Excluding January.

Table II.

MONTHLY SUNSHINE AT THE TRIAL STATIONS—IN HOURS—SEASONS 1936-38.

Month.	Cannington			Newport.			Sprowston.			Harswell and Selby,* Yorkshire.		
	1936	1937	1938	1936	1937	1938	1936	1937	1938	1936	1937	1938
January	42·1	48·0	45·4	45·5	†	44·5	48·4	50·4	45·2	41·9	34·8	51·5
February	70·3	64·7	63·8	76·1	51·6	55·3	74·1	63·3	85·3	74·9	74·7	63·9
March	84·5	108·7	137·9	55·4	85·1	129·3	85·3	104·1	173·8	61·9	72·7	127·0
April	156·4	125·4	212·5	165·0	111·6	164·0	168·4	56·8	151·1	175·5	75·2	143·1
May	205·7	210·1	162·3	140·2	154·6	146·5	195·7	162·1	167·3	176·9	164·2	168·6
June	165·7	227·6	209·8	123·0	135·0	179·3	212·9	191·7	189·9	164·1	160·1	172·3
July	148·9	132·9	152·9	117·8	121·4	124·2	162·5	114·4	164·9	144·3	133·4	134·8
August	229·9	221·2	158·7	163·8	180·2	126·7	159·9	167·6	163·3	176·6	156·3	147·1
September	115·5	141·6	122·0	103·8	145·7	109·8	137·0	152·4	111·7	100·9	136·8	119·3
October	110·4	72·7	107·0	97·3	72·4	96·5	104·8	86·9	116·0	95·0	53·9	68·6
November	48·4	46·2	59·6	42·0	62·4	79·1	50·4	47·7	63·5	49·4	63·5	49·7
December	61·4	38·5	55·9	44·9	20·7	50·2	56·8	25·6	39·3	44·2	30·8	37·6
Total for year ...	1439·2	1437·6	1487·8	1174·8	1140·7‡	1305·4	1456·2	1223·0	1471·3	1305·6	1156·4	1283·5
Total March - Oct. ...	1217·0	1240·2	1263·1	966·3	1006·0	1076·3	1226·5	1036·0	1238·0	1095·2	952·6	1080·8

* The records given under the two Yorkshire centres were taken at Askham Bryan, near York.
† Figures unreliable.
‡ Excluding January.

Table III.

MAIN TRIALS, 1936-1938.

PERCENTAGE OF BOLTERS.

The strains are arranged in the order of the general average percentage of bolters.

Strain.	Cannington.			Newport.			Sprowston.			Harswell.			Selby.			General average percentage
	1936	1937	1938	1936	1937	1938	1936	1937	1938	1936	1937	1938	1936	1937	1938	
Erhard Frederiksen's No. 472	0·00	0·00	0·18	0·03	0·21	0·01	0·52	0·07	0·50	0·09	0·37	0·18	0·34	0·20	0·00	0·18
Kleinwanzleben E (control)	0·01	0·00	0·04	0·08	0·10	0·71	0·76	0·18	0·63	0·25	0·20	0·14	0·51	0·10	0·13	0·26
Erhard Frederiksen's No. 120	0·00	0·00	0·09	0·07	0·08	1·12	1·81	0·65	1·35	0·72	0·42	0·18	0·92	0·10	0·16	0·51
Dobrovice V.E.	0·01	0·03	0·42	0·43	0·69	1·77	1·70	1·08	2·37	1·09	0·88	0·24	1·15	0·30	0·36	0·83
Buszczynski N.P. (English)	—	0·00	0·76	—	0·26	2·64	—	0·78	3·64	—	0·56	0·22	—	0·20	0·63	0·97
Buszczynski N.P. (Polish)	0·01	0·10	0·49	0·49	0·34	1·90	2·80	0·76	3·04	1·60	0·98	0·39	2·02	0·50	0·17	1·04
Braune E	0·01	0·03	0·27	0·58	0·44	2·07	2·94	1·30	3·52	1·48	0·71	0·15	2·27	0·60	0·63	1·13
Schreiber S.K.W. ...	0·02	0·07	0·53	0·61	0·86	2·43	3·74	1·23	3·85	2·00	0·75	0·42	1·93	0·90	0·65	1·33
Mette S.P.	0·03	0·14	—	1·01	0·80	—	4·85	2·10	—	2·51	2·97	—	2·81	1·20	—	1·84
Rimpau Z	0·00	0·07	1·77	0·85	0·80	4·53	3·46	1·34	6·66	1·06	2·44	0·68	2·63	1·50	1·36	1·94
Average of all strains ...	0·01	0·04	0·51	0·46	0·46	1·91	2·51	0·95	2·84	1·20	1·03	0·29	1·62	0·56	0·45	—

Table IV.

MAIN TRIALS, 1936-38.

NUMBER OF ROOTS PER ACRE EXPRESSED AS A PERCENTAGE OF KLEINWANZLEBEN E.

The strains are arranged in the order of the general average number of roots per acre.

Strain.	Cannington.				Newport.				Sprowston.				Harswell.				Selby.				General average.
	1936	1937	1938	1936–1938	1936	1937	1938	1936–1938	1936	1937	1938	1936–1938	1936	1937	1938	1936–1938	1936	1937	1938	1936–1938	
Erhard Frederiksen's No. 472 .	108	101	99	103	113	98	97	103	108	107	97	104	111	98	102	104	111	109	103	108	104
Mette S.P. ...	103	102	—	—	110	91	—	—	107	102	—	—	101	98	—	—	112	101	—	—	103
Erhard Frederiksen's No. 120 .	103	99	96	99	109	93	94	99	107	102	98	102	107	101	98	102	105	108	108	107	102
Buszczynski N.P. (Polish) ...	103	100	101	101	109	92	95	99	112	102	98	104	108	94	94	99	107	110	101	106	102
Braune E ...	104	102	101	102	106	87	100	98	100	102	96	99	107	98	97	101	108	107	103	106	101
Rimpau Z ...	104	99	97	100	108	92	95	98	107	102	92	100	106	93	96	98	110	104	107	107	101
Kleinwanzleben E (control) ...	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Schreiber S.K.W.	99	96	102	99	106	93	97	99	104	101	100	102	102	97	96	98	98	98	99	98	99
Dobrovice V.E. .	103	101	96	100	106	86	95	96	106	103	97	102	107	97	89	98	106	103	92	100	99
Buszczynski N.P. (English) ...	—	99	101	—	—	94	98	—	—	99	97	—	—	94	98	—	—	101	103	—	98
Number of roots per acre of Kleinwanzleben E ...	31,000	28,890	22,230	—	26,130	28,670	26,660	—	24,890	27,170	27,110	—	31,127	30,260	27,660	—	23,760	28,440	30,972	—	—

Table V.

MAIN TRIALS, 1936-38.

WEIGHT OF INDIVIDUAL ROOTS EXPRESSED AS A PERCENTAGE OF KLEINWANZLEBEN E.

The strains are arranged in the order of their general average root weights.

Strain.	Cannington.				Newport.				Sprowston.				Harswell.				Selby.				General average.
	1936	1937	1938	1936–1938	1936	1937	1938	1936–1938	1936	1937	1938	1936–1938	1936	1937	1938	1936–1938	1936	1937	1938	1936–1938	
Kleinwanzleben E (control) ...	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Erhard Frederiksen's No. 120	89	88	94	90	89	103	101	98	88	96	103	96	93	91	99	94	95	86	92	91	93·8
Buszczynski N.P. (English) ...	—	93	86	—	—	103	92	—	—	94	96	—	—	95	94	—	—	90	94	—	93·7
Schreiber S.K.W. ...	91	95	90	92	83	105	96	95	90	99	90	93	88	92	98	93	86	88	96	90	92·5
Braune E	92	93	90	92	88	109	93	97	89	94	99	94	85	87	93	88	95	87	91	91	92·3
Dobrovice V.E. ...	90	87	93	90	84	112	93	96	83	89	83	85	86	96	103	95	92	86	95	91	91·4
Buszczynski N.P. (Polish) ...	90	91	89	90	87	106	95	96	80	94	96	90	78	90	98	89	87	83	94	88	90·5
Erhard Frederiksen's No. 472	83	87	96	89	87	100	100	96	85	90	88	88	92	85	89	89	90	83	100	91	90·3
Mette S.P. ...	90	84	—	—	78	101	—	—	85	89	—	—	79	95	—	—	86	88	—	—	87·5
Rimpau Z ...	87	90	86	88	80	97	90	89	82	93	82	86	75	87	86	83	82	79	80	80	85·1
Average weight of Kleinwanzleben E roots, lb. ...	1·08	1·01	1·40	1·16	1·40	1·15	1·16	1·24	1·36	1·09	0·72	1·06	0·85	1·06	1·01	0·97	1·18	0·77	0·79	0·91	1·07

Table VI.

MAIN TRIALS, 1936-38.

YIELD OF WASHED ROOTS PER ACRE EXPRESSED AS A PERCENTAGE OF KLEINWANZLEBEN E.

The strains are arranged in the order of their general average yields.

Strain.	Cannington.				Newport.				Sprowston.				Harswell.				Selby.				General average.
	1936	1937	1938	1936–1938	1936	1937	1938	1936–1938	1936	1937	1938	1936–1938	1936	1937	1938	1936–1938	1936	1937	1938	1936–1938	
Kleinwanzleben E (control) ...	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Erhard Frederiksen's No. 120 ...	91	88	90	90	96	95	94	95	94	99	101	98	99	92	97	96	100	93	99	97	95·2
Erhard Frederiksen's No. 472 ...	90	88	95	91	99	98	97	98	92	96	84	91	102	82	91	92	100	90	103	98	93·8
Braune E	96	95	91	94	93	95	92	93	88	97	95	93	91	85	91	89	103	94	94	97	93·3
Buszczynski N.P. (English) ...	—	92	87	—	—	98	90	—	—	94	93	—	—	89	92	—	—	91	97	—	92·3
Buszczynski N.P. (Polish) ...	93	90	90	91	96	98	90	95	90	97	94	94	84	85	92	87	93	91	95	93	91·9
Schreiber S.K.W. ...	90	91	92	91	88	98	93	93	93	100	90	94	90	88	94	91	84	87	95	89	91·5
Dobrovice V.E. ...	93	88	88	90	89	96	88	91	88	91	81	87	93	93	92	93	98	89	91	93	90·5
Mette S.P. ...	93	86	—	—	85	92	—	—	91	91	—	—	80	93	—	—	97	90	—	—	89·8
Rimpau Z	91	89	83	88	87	88	85	87	88	94	76	86	80	81	83	81	91	82	86	86	85·6
Significant difference = ± per cent of control	3·90	7·08	4·50	—	5·30	7·96	4·50	—	7·70	6·87	6·00	—	15·10	11·10	6·50	—	13·40	9·49	7·40	—	—
Yield of Kleinwanzleben E in tons per acre ...	14·96	13·03	13·92	13·97	16·29	14·70	13·86	14·95	15·13	13·19	8·67	12·33	11·89	14·38	12·42	12·90	12·46	9·75	10·97	11·06	13·04

Table VII.

MAIN TRIALS, 1936-38.

SUGAR CONTENT OF ROOTS EXPRESSED AS A PERCENTAGE OF KLEINWANZLEBEN E.

The strains are arranged in the order of their general average sugar content.

Strain.	Cannington.				Newport.				Sprowston.				Harswell.				Selby.				General average.
	1936	1937	1938	1936–1938	1936	1937	1938	1936–1938	1936	1937	1938	1936–1938	1936	1937	1938	1936–1938	1936	1937	1938	1936–1938	
Rimpau Z	105·1	107·4	103·4	105·3	106·7	101·8	106·5	105·0	106·4	107·4	104·0	105·9	103·7	102·6	102·9	103·1	103·3	106·4	104·9	104·9	104·8
Braune E ...	103·1	104·7	102·0	103·3	99·4	99·4	101·9	100·2	101·8	104·3	104·7	103·6	103·1	102·6	99·3	101·7	107·8	103·5	104·3	105·2	102·9
Dobrovice V.E. ...	102·6	106·7	103·4	104·2	101·7	100·0	100·6	100·8	104·7	106·2	104·0	105·0	106·2	102·1	102·9	103·7	98·9	102·3	101·8	101·0	102·9
Buszczynski N.P. (English) ...	—	106·0	104·7	—	—	100·0	101·3	—	—	103·1	103·4	—	—	101·6	102·9	—	—	99·4	104·3	—	102·7
Buszczynski N.P. (Polish)	103·1	105·3	104·1	104·2	100·0	100·0	101·9	100·6	103·4	101·2	102·7	102·4	103·1	101·6	104·3	103·0	97·2	102·3	104·3	101·2	102·3
Mette S.P. ...	103·1	104·0	—	—	100·0	99·4	—	—	101·8	103·7	—	—	103·7	100·5	—	—	98·3	105·2	—	—	102·0
Erhard Frederiksen's No. 120	100·0	102·0	101·4	101·1	101·1	98·8	101·9	100·6	100·5	103·1	99·3	101·0	102·5	101·6	102·2	102·1	107·8	105·8	101·2	104·9	101·9
Erhard Frederiksen's No. 472	102·6	104·0	101·4	102·7	102·2	100·6	100·6	101·1	100·5	106·2	97·3	101·3	105·0	104·2	99·3	102·8	103·3	102·3	97·6	101·1	101·8
Schreiber S.K.W. ...	102·6	100·6	100·7	101·3	101·1	99·4	100·6	100·4	101·8	101·8	101·3	101·6	106·2	100·0	99·3	101·8	101·1	104·0	103·7	102·9	101·6
Kleinwanzleben E (control) ...	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0
Percentage of sugar in Kleinwanzleben E	15·8	14·9	14·7	15·1	17·8	16·7	15·5	16·7	17·0	16·2	14·9	16·0	16·0	18·9	14·0	16·3	17·9	17·2	16·4	17·2	16·26

Table VIII.

MAIN TRIALS, 1936-38.

YIELD OF SUGAR PER ACRE EXPRESSED AS A PERCENTAGE OF KLEINWANZLEBEN E.

The strains are arranged in the order of their general average sugar yields.

Strain.	Cannington.				Newport.				Sprowston.				Harswell.				Selby.				General average.
	1936	1937	1938	1936–1938	1936	1937	1938	1936–1938	1936	1937	1938	1936–1938	1936	1937	1938	1936–1938	1936	1937	1938	1936–1938	
Kleinwanzleben E (control) ...	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Erhard Frederiksen's No. 120	91	90	91	91	97	95	96	96	95	101	100	99	102	93	100	98	108	98	101	102	97·2
Braune E	99	100	93	97	93	94	94	94	90	101	99	97	94	87	90	90	111	98	98	102	96·1
Erhard Frederiksen's No. 472	93	92	96	94	101	99	98	99	92	102	82	92	107	96	90	94	104	92	101	99	95·7
Buszczynski N.P. (English) ...	—	98	91	—	—	98	91	—	—	97	97	—	—	90	94	—	—	91	101	—	94·8
Buszczynski N.P. (Polish)	96	95	94	95	96	98	91	95	93	98	97	96	86	86	96	89	91	93	99	94	93·9
Dobrovice V.E. ...	96	94	91	94	90	97	88	92	92	97	84	91	99	95	95	96	97	91	93	94	93·2
Schreiber S.K.W. ...	92	92	92	92	89	98	93	93	95	102	91	96	96	88	93	92	85	90	98	91	92·9
Mette S.P.	96	89	—	—	86	91	—	—	92	94	—	—	83	93	—	—	96	94	—	—	91·4
Rimpau	96	95	86	92	93	90	90	91	93	101	79	91	83	83	85	84	94	87	90	90	89·7
Yield of sugar in tons per acre from Kleinwanzleben E.	2·36	1·94	2·05	2·12	2·90	2·45	2·15	2·50	2·57	2·14	1·29	2·00	1·90	2·72	1·74	2·12	2·23	1·68	1·80	1·90	2·13

Table IX.

SUGAR BEET MAIN TRIALS, 1936-1938.

SUMMARY OF GENERAL AVERAGE RESULTS (from Tables III - VIII) OF SUGAR BEET STRAINS AT CANNINGTON, NEWPORT, SPROWSTON, HARSWELL AND SELBY EXPRESSED AS A PERCENTAGE OF KLEINWANZLEBEN E.

(The strains are arranged in the order of their general average yields of sugar).

Strain.	Expressed as a percentage of Kleinwanzleben E.				Percentage of bolters.
	Yield of washed beet.	Root weight.	Sugar content.	Yield of sugar.	
Kleinwanzleben E (control) ..	**100·0**	**100·0**	**100·0**	**100·0**	**0·26**
Erhard Frederiksen's No. 120 ...	95·2	93·8	101·9	97·2	0·51
Braune E	93·3	92·3	102·9	96·1	1.13
Erhard Frederiksen's No. 472 ..	93·8	90·3	101·8	95·7	0.18
*Buszczynski N.P. (English) .	92·3	93·7	102·7	94·8	0·97
Buszczynski N.P. (Polish) .	91·9	90·5	102·3	93·9	1·04
Dobrovice V.E.	90·5	91·5	102·9	93·2	0·83
Schreiber S.K.W.	91·5	92·5	101·6	92·9	1·33
*Mette S.P.	89·8	87·5	102·0	91·4	1·84
Rimpau Z	85·6	85·1	104·8	89·7	1·94
General average yield, etc. of the control strain	13·04 tons per acre.	1·07 lb.	16·26 per cent.	2·13 tons per acre.	—

*The figures for Buszczynski (English) are the average for 1937 and 1938; and for Mette the average for 1936 and 1937.

The comparable figures for Buszczynski (Polish) for the two seasons 1937 and 1938 were:—

Yield of washed beet 92·2; root weight 93·6; sugar content 102·8; yield of sugar 94·7; and percentage of bolters 0·87.

Table X.

MAIN TRIALS, 1936-38.

AVERAGE VALUE OF SUGAR BEETS PER ACRE AT FIVE CENTRES, 1936-1938.

Strain.	Average weight of washed beets.	Average sugar content.	Calculated on basic price of 46/- per ton for 15·5% sugar content beet.		Calculated on basic price of 48/- per ton for 15·5% sugar content beet.		Average value as per cent. of Kleinwanzleben E.
			Average price per ton at factory.	Average value of roots per acre	Average price per ton at factory.	Average value of roots per acre	
	Tons per acre.	Per cent.	s. d.	£ s. d.	s. d.	£ s. d.	Per cent.
Kleinwanzleben E (control) ...	13·04	16·3	48 0	31 5 11	50 0	32 12 0	100·0
Erhard Frederiksen's No. 120 ...	12·39	16·6	48 9	30 4 0	50 9	31 8 10	96·4
Erhard Frederiksen's No. 472 ...	12·26	16·6	48 9	29 17 8	50 9	31 2 2	95·4
Braune E	12·15	16·7	49 0	29 15 4	51 0	30 19 8	95·0
Buszczynski N.P. (Polish) ...	11·98	16·6	48 9	29 4 0	50 9	30 8 0	93·2
Dobrovice V.E.	11·85	16·7	49 0	29 0 8	51 0	30 4 4	92·7
Schreiber S.K.W.	11·95	16·5	48 6	28 19 7	50 6	30 3 6	92·6
Rimpau Z	11·21	17·0	49 9	27 17 8	51 9	29 0 1	89·0
Kleinwanzleben E (control) (1936 and 1937)	13·58	16·8	49 3	33 8 10	51 3	34 16 0	100·0
Mette S.P. (1936 and 1937)	12·19	17·2	50 3	30 12 7	52 3	31 16 11	91·5
Kleinwanzleben E (control) (1937 and 1938)	12·49	15·9	47 0	29 7 0	49 0	30 12 0	100·0
Buszczynski N.P. (English) (1937 and 1938)	11·52	16·4	48 3	27 15 10	50 3	28 18 11	94·6

Table XI.

SUPPLEMENTARY SUGAR BEET TRIALS, 1936-1938.

PERCENTAGE OF BOLTERS.

The strains are arranged in the order of the general average percentage of bolters

Strain.	Cannington.			Newport.			Sprowston			Harswell.			General average percentage.
	1936	1937	1938	1936	1937	1938	1936	1937	1938	1936	1937	1938	
Marsters' British Hilleshog ...	*	0·03	0·09	0·03	0·00	0·07	0·11	0·08	0·10	0·12	0·11	0·00	0·07
Kleinwanzleben E (German) (control)	0·00	0·00	0·00	0·06	0·15	0·80	2·19	0·23	1·07	0·38	0·04	0·04	0·41
Kleinwanzleben E (Sharpe's English)	*	0·00	0·09	0·09	0·31	0·76	1·85	0·34	1·23	0·31	0·11	0·00	0·46
Cannell's No. 937	0·03	0·00	0·34	0·00	0·07	2·72	1·57	0·61	2·37	0·03	0·00	0·19	0·66
Johnson's Perfection	*	0·00	0·00	0·00	0·55	0·90	4·51	1·49	0·40	0·62	0·11	0·00	0·78
Gartons' B	0·13	0·03	0·28	0·41	0·62	1·91	3·10	1·57	1·79	0·10	0·37	0·00	0·86
Webb's No. 2	0·00	0·00	0·05	0·80	0·21	0·71	12·43	0·34	0·10	0·87	0·07	0·04	1·29
Carter's No. 3	0·20	0·11	0·32	0·33	0·71	1·22	7·60	0·97	3·12	0·66	0·32	0·15	1·31
Dippe E (Battle's English) ...	*	0·17	0·46	0·26	1·48	2·75	4·87	1·55	3·94	0·53	0·91	0·08	1·55
Average of all strains	0·07	0·04	0·18	0·22	0·46	1·32	4·24	0·80	1·57	0·40	0·23	0·05	—

* Not grown at Cannington in 1936.

Table XII.

SUPPLEMENTARY SUGAR BEET TRIALS, 1936-1938.

NUMBER OF ROOTS PER ACRE EXPRESSED AS A PERCENTAGE OF KLEINWANZLEBEN E.

The strains are arranged in the order of the general average number of roots per acre.

Strain	Cannington.			Newport.			Sprowston.			Harswell.			General average.
	1936	1937	1938	1936	1937	1938	1936	1937	1938	1936	1937	1938	
Kleinwanzleben E (Sharpe's English)	—	100	101	100	110	96	104	101	98	103	100	98	101·0
Dippe E (Battle's English)	—	102	103	97	98	96	109	106	99	103	100	97	100·9
Johnson's Perfection	—	98	102	96	104	100	102	102	103	98	99	104	100·7
Cannell's No. 937	99	103	97	97	102	95	106	101	99	105	101	99	100·3
Carter's No. 3	100	99	102	94	107	95	104	102	98	101	101	100	100·2
Marsters' British Hilleshog ...	—	101	99	92	100	98	105	100	99	104	101	102	100·1
Kleinwanzleben E (German) (control)	100	100	100	100	100	100	100	100	100	100	100	100	100·0
Webb's No. 2	100	97	103	90	111	98	96	102	99	103	100	100	100·0
Garton's B	100	97	103	93	98	95	100	102	100	101	98	100	98·9
Number of roots per acre of Kleinwanzleben E	33,355	28,550	21,250	31,850	26,260	28,710	25,060	26,160	29,030	31,230	27,640	26,270	27,947

Table XIII.

SUPPLEMENTARY SUGAR BEET TRIALS, 1936-1938.

WEIGHT OF INDIVIDUAL ROOTS EXPRESSED AS A PERCENTAGE OF KLEINWANZLEBEN E.

The strains are arranged in the order of their general average root weights.

Strain.	Cannington.				Newport.				Sprowston.				Harswell.				General average.
	1936	1937	1938	1936–1938	1936	1937	1938	1936–1938	1936	1937	1938	1936–1938	1936	1937	1938	1936–1938	
Kleinwanzleben E. (German) (control)	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Kleinwanzleben E (Sharpe's English)	—	110	97	—	100	89	100	96	103	94	108	102	96	95	104	98	99·6
Cannell's No. 937 ...	92	94	107	98	96	92	108	99	94	99	110	101	83	102	109	98	98·8
Dippe E (Battle's English)	—	101	90	—	94	94	101	96	89	91	102	94	85	96	104	95	95·2
Carter's No. 3 ..	94	96	91	94	96	83	100	93	87	89	100	92	91	89	93	91	92·4
Gartons' B	84	90	89	88	96	92	100	96	90	87	97	91	84	97	95	92	91·8
Johnson's Perfection .	—	95	96	—	94	82	99	92	91	88	93	91	85	90	96	90	91·7
Webb's No. 2	89	94	91	91	100	74	96	90	91	87	88	89	89	88	97	91	90·3
Marsters' British Hilleshog	—	80	89	—	98	80	97	92	87	83	92	87	79	85	88	84	87·1
Average weight of Kleinwanzleben E roots, lb.	1·08	0·93	1·40	1·14	1·14	1·33	1·06	1·18	1·48	1·27	0·60	1·12	1·17	1·22	1·07	1·15	1·146

Table XIV.

SUPPLEMENTARY SUGAR BEET TRIALS, 1936-1938.

YIELD OF WASHED ROOTS PER ACRE EXPRESSED AS A PERCENTAGE OF KLEINWANZLEBEN E.

The strains are arranged in the order of their general average yields.

Strain.	Cannington.				Newport.				Sprowston.				Harswell.				General average.
	1936	1937	1938	1936–1938	1936	1937	1938	1936–1938	1936	1937	1938	1936–1938	1936	1937	1938	1936–1938	
Kleinwanzleben E (Sharpe's English)	—	110	99	—	99	98	96	98	107	96	106	103	99	96	102	99	100·7
Kleinwanzleben E (German) (control) ...	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100·0
Cannell's No. 937 ...	91	97	104	97	93	95	102	97	101	100	109	103	88	103	108	100	99·3
Dippe E (Battle's English)	—	103	93	—	91	93	97	94	97	96	100	98	88	96	100	95	95·8
Johnson's Perfection ...	—	93	98	—	90	85	99	91	93	91	95	93	86	90	100	92	92·7
Carter's No. 3 ...	93	95	93	94	91	90	95	92	91	91	98	93	93	90	92	92	92·7
Garton's B	85	87	91	88	88	91	95	91	91	89	96	92	85	95	95	92	90·7
Webb's No. 2	89	91	93	91	91	82	95	89	87	89	88	88	92	88	97	92	90·2
Marsters' British Hilleshog	—	89	88	—	90	81	95	89	91	84	90	88	83	86	90	86	87·1
Significant difference = ± per cent. of control	3·50	11·71	5·50	—	4·40	8·76	5·90	—	6·10	6·62	10·00	—	10·70	13·60	7·10	—	—
Yield of Kleinwanzleben E in tons per acre...	16·11	11·83	13·26	13·73	16·21	15·53	13·55	15·10	16·56	14·78	7·79	13·04	16·25	15·07	12·59	14·64	14·13

Table XV.

SUPPLEMENTARY SUGAR BEET TRIALS, 1936-1938.

SUGAR CONTENT OF ROOTS EXPRESSED AS A PERCENTAGE OF KLEINWANZLEBEN E.

The strains are arranged in the order of their general average sugar content.

Strain.	Cannington				Newport				Sprowston				Harswell				General average.
	1936	1937	1938	1936–1938	1936	1937	1938	1936–1938	1936	1937	1938	1936–1938	1936	1937	1938	1936–1938	
Marsters' British Hilleshog	—	103·2	107·2	—	103·3	105·6	98·7	102·5	107·4	103·5	104·0	105·0	107·7	108·5	108·8	108·3	105·3
Gartons' B	104·5	103·2	101·3	103·0	101·7	103·3	99·4	101·5	106·7	101·8	102·0	103·5	106·1	105·4	104·1	105·2	103·3
Johnson's Perfection ...	—	103·2	102·0	—	100·5	103·9	101·9	102·1	103·1	101·2	104·0	102·8	103·9	105·4	104·7	104·7	103·1
Webb's No. 2	102·2	103·2	103·9	103·1	94·4	106·7	101·9	101·0	101·8	103·5	104·0	103·1	98·3	107·3	104·1	103·2	102·6
Cannell's No. 937 ...	101·1	100·6	99·3	100·3	95·0	102·8	99·4	99·1	103·1	100·0	100·0	101·0	103·9	101·2	101·4	102·2	100·7
Kleinwanzleben E (German) (control) .	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0
Kleinwanzleben E (Sharpe's English) ...	—	100·0	97·4	—	97·2	100·5	97·5	98·4	100·0	98·2	102·7	100·3	96·6	103·0	100·7	100·1	99·4
Carter's No. 3 ...	100·0	100·0	99·3	99·8	93·9	100·0	96·8	96·9	100·6	102·9	100·0	101·2	100·0	101·2	98·0	99·7	99·4
Dippe E (Battle's English)	—	98·7	98·0	—	93·3	100·0	97·5	96·9	101·8	98·2	100·7	100·2	99·4	99·4	97·3	98·7	98·6
Percentage of sugar in Kleinwanzleben E .	17·9	15·4	15·2	16·2	18·0	17·7	15·7	17·1	16·2	16·8	15·0	16·0	18·0	16·5	14·8	16·4	16·43

Table XVI.

SUPPLEMENTARY SUGAR BEET TRIALS, 1936-1938.

YIELD OF SUGAR PER ACRE EXPRESSED AS A PERCENTAGE OF KLEINWANZLEBEN E.

The strains are arranged in the order of their general average sugar yield.

Strain.	Cannington.				Newport.				Sprowston.				Harswell.				General average.
	1936	1937	1938	1936–1938	1936	1937	1938	1936–1938	1936	1937	1938	1936–1938	1936	1937	1938	1936–1938	
Kleinwanzleben E (Sharpe's English) .	—	110	97	—	96	99	94	96	107	95	109	104	96	98	102	99	100·3
Kleinwanzleben E (German) (control) .	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100·0
Cannell's No. 937 ..	92	97	104	98	88	97	102	96	104	100	109	104	91	104	109	101	99·8
Johnson's Perfection ,	—	96	100	—	90	88	102	93	96	92	98	95	89	94	105	96	95·5
Dippe E (Battle's English)	—	102	92	—	85	93	95	91	99	95	101	98	88	95	98	94	94·8
Gartons' B	89	90	92	90	90	94	96	93	97	90	97	95	90	100	99	96	93·7
Webb's No. 2	91	93	97	94	86	88	98	91	89	92	91	91	90	94	101	95	92·5
Carter's No. 3 ...	93	95	93	94	85	90	93	89	91	94	98	94	93	90	91	91	92·2
Marsters' British Hilleshog	—	83	95	—	93	85	95	91	98	87	93	93	89	94	98	94	91·8
Yield of sugar in tons per acre from Kleinwanzleben E ...	2·88	1·82	2·01	2·24	2·92	2·75	2·13	2·60	2·68	2·48	1·17	2·11	2·93	2·49	1·86	2·43	2·34

Table XVII.

SUGAR BEET SUPPLEMENTARY TRIALS (ENGLISH-GROWN SEED), 1936-1938.

SUMMARY OF GENERAL AVERAGE RESULTS (from Tables XI - XVI) OF SUGAR BEET STRAINS AT CANNINGTON, NEWPORT, SPROWSTON AND HARSWELL EXPRESSED AS A PERCENTAGE OF KLEINWANZLEBEN E.

The strains are arranged in the order of their general average yields of sugar

Strain.	Expressed as a percentage of Kleinwanzleben E				Percentage of bolters.
	Yield of washed beet.	Root weight.	Sugar content.	Yield of sugar.	
*Kleinwanzleben E (Sharpe's English)	100·7	99·6	99·4	100·3	0·46
Kleinwanzleben E (German) (control)	100·0	100·0	100·0	100·0	0·41
Cannell's No. 937	99·3	98·8	100·7	99·8	0·66
*Johnson's Perfection	92·7	91·7	103·1	95·5	0·78
*Dippe E (Battle's English) ...	95·8	95·2	98·6	94·8	1·55
Gartons' B	90·7	91·8	103·3	93·7	0·86
Webb's No. 2	90·2	90·3	102·6	92·5	1·29
Carter's No. 3	92·7	92·4	99·4	92·2	1·31
*Marsters' British Hilleshog ...	87·1	87·1	105·3	91·8	0·07
General average yield, etc. of the control strain	14·13 tons per acre	1·146 lb.	16·43 per cent.	2·34 tons per acre.	—

* These were not grown at Cannington in 1936.

Table XVIII.

SUPPLEMENTARY SUGAR BEET TRIALS, 1936-1938.

AVERAGE VALUE OF BEETS PER ACRE AT FOUR CENTRES, 1936-1938.

Strain.	Average weight of washed beets.	Average sugar content.	Calculated on basic price of 46/- per ton for 15·5% sugar content beet.		Calculated on basic price of 48/- per ton for 15·5% sugar content beet.		Average value as per cent. of Kleinwanzleben E.
			Average price per ton at factory.	Average value of roots per acre	Average price per ton at factory.	Average value of roots per acre	
	Tons per acre	Per cent.	s. d.	£ s. d.	s. d.	£ s. d.	Per cent.
Kleinwanzleben E (German) (control)	14·13	16·4	48 3	34 1 9	50 3	35 10 0	100·0
Cannell's No. 937	13·90	16·5	48 6	33 14 2	50 6	35 2 0	98·8
Kleinwanzleben E (Sharpe's English)	13·98	16·2	47 9	33 7 6	49 9	34 15 6	97·9
Gartons' B	12·76	17·0	49 9	31 14 10	51 9	33 0 4	93·0
Dippe E (Battle's English) ...	13·32	16·1	47 6	31 12 8	49 6	32 19 4	92·9
Johnson's Perfection	12·85	16·8	49 3	31 12 10	51 3	32 18 6	92·7
Webb's No. 2	12·71	16·9	49 6	31 9 2	51 6	32 14 7	92·2
Carter's No. 3	13·03	16·3	48 0	31 5 5	50 0	32 11 6	91·8
Marsters' British Hilleshog ...	12·16	17·2	50 3	30 11 0	52 3	31 15 4	89·5

TRIALS OF CHICORY STRAINS, 1936-1938

S. F. ARMSTRONG, M.A.

The coffee chicory (*Cichorium Intybus L. var. sativus*) is an important crop in some parts of Central Europe and in Belgium. The roots, after being washed, dried, roasted and ground are used for mixing with coffee. In England the crop is at present limited to about twelve hundred acres situated chiefly in the fen districts of the Isle of Ely, Huntingdonshire and West Suffolk. On the whole it is an easy crop to grow and is relatively free from attacks of pests and diseases. It is important to note that this plant is immune to the sugar beet eelworm (*Heterodera schachtii*, Schmidt), and as it occupies the same place in the rotation as sugar beet it offers an ideal substitute for that crop where land is infected with this parasite.

The present trials had their origin in an enquiry received in 1936 from Messrs. Chicory Limited, St. Ives, Hunts., who are engaged in the commercial drying of the crop. Information was sought as to the relative merits of different types or strains of chicory both from the growers' and dryers' point of view, but no experimental evidence on this matter was available for this country. It seemed desirable that such information should be obtained, and these trials were therefore the result of collaboration between the Institute and Messrs. Chicory Limited. The Institute planned the trial technique and supervised the work, while Messrs. Chicory Limited undertook to wash the roots, dry the samples, and bear the actual trial costs, including the provision of land. Messrs. Chivers & Sons Limited, of Histon, also showed their interest in the work and provided seed of some of the strains tested.

METHOD OF TRIAL.

It was known that the strains of chicory available fell roughly into three types according to their root shape, viz. the long, half-long and stump-rooted types. Each of these types was, therefore, included in these trials, and a strain of the stump-rooted type—Pont de Pierre—was chosen as the control.

Each strain was grown in plots replicated eight times in randomized blocks. Each plot consisted of six rows—the width of the drill—but only the four inner rows were included in the actual weighed portion which covered an area of 1/120th acre in 1937 and 1/100th acre in the other two seasons. The rows were spaced 13 inches apart (14 inches in the 1938 trials) and the plants were singled to approximately 6 inches apart. Seed was sown at the rate of 4 lb. per acre, which proved to be ample. Very good and regular plant populations were secured each season and, except for an initial horse hoeing, all the cleaning of the crops and the lifting was done by hand labour. Samples of roots were taken previous to harvesting the crop. Each sample consisted of 24 roots and included three roots from each of the eight plots. The moisture content of the samples was determined at the St. Ives factory.

After lifting the roots were bagged, and as a precaution the weight of roots on each plot recorded. Immediately afterwards they were taken to the factory, where they were washed and the washed weights of each plot taken. In the case of each strain the roots were remarkably free from fangs, a circumstance which is partly due to the open character of the soil on which they were grown. In 1936 the whole of the weighed produce of each strain was sliced and dried under similar conditions at the factory, but this was not undertaken in the following years.

THE 1936 TRIALS.

These were on a deep black fen soil which had been clayed three years before. The bed of clay was from 3 to 4 feet below the surface. In the previous season the land was cropped with sugar beet and before that with potatoes. The soil was ploughed a foot deep during the winter, and in the spring a firm moist seed bed was prepared. In this trial, as in the subsequent ones, the only manure applied directly to the crop was superphosphate which was sown with the seed at the rate of 2½ cwt. per acre. Sowing was done on the 8th May. The plants had brairded by the 1st June and were spaced and singled before the end of the month. Subsequent growth was very satisfactory, and samples of roots were taken at five different dates commencing with the 5th October and ending on the 30th November, with fourteen day intervals between each sampling. These repeated samples were taken to observe what changes were occurring in the root weight and dry matter content, and to enable a decision to be made as to the best date for lifting. The crop was lifted during the second week of December. The strains grown are shown in Table I.

THE 1937 TRIALS.

In 1937 Vilmorin's La Productive was added, while Magdeburg, owing to its unsuitable root shape, was dropped. The soil was of a similar character to that used in 1936, but was more fertile and had a rather higher clay content. The preceding crops were, sugar beet in 1936, and potatoes in 1935. The varieties were sown on the 10th May under favourable conditions. Growth during the season was satisfactory and the strains were sampled at four fortnightly intervals which commenced on the 18th October. Lifting was done during the last week of the year.

THE 1938 TRIALS.

In 1938 the Half-long type was discontinued owing to its inferior yield, while tests of the four remaining strains were continued. The trials were grown on the same field as the 1936 trials, though not on the same site. The previous crop was sugar beet. Although everything possible was done in preparation for sowing, the season was so exceptionally dry that drilling was not possible before the 17th May. Even then the tilth was very dry and as a result the seed was covered too deeply. The " plant " obtained was very defective and the trial had to be resown on the 14th June. A full " plant " was secured from the second sowing, but although the crop grew well there was insufficient time for full development of the roots before the foliage was

cut down by severe frosts which set in on the 19th December and continued for some time afterwards. This explains the low yields obtained in 1938 and possibly also the low dry matter content of the latest samples. Root samples were taken on the 5th December and again on the 10th January 1939. The roots were lifted between the 24th-30th January.

YIELDS OF RAW CHICORY. (Table I).

The term " raw chicory " is used in two different senses. The chicory dryer refers to the washed undried root as " raw chicory ", and it is in this sense that the word is used here. On the other hand, the dried but unroasted root as delivered by the chicory dryer, or as imported, is described as " raw chicory " by the roaster.

The Magdeburg strain gave a significantly higher yield than the control in 1936, but was not tested further owing to its unsatisfactory root shape. The Half-long strains were both outyielded to a significant extent by the control, and after the poor result of 1937 this type was also discontinued.

Panses de Brochets gave significantly higher yields than the control in 1936 and 1937, and an equivalent yield in 1938. It gave the highest average yield of roots over the three seasons and its average yield of washed roots exceeded the control by 12 per cent. Vilmorin's La Productive gave a significantly higher yield than the control in 1937; in the two years when it was under trial this strain gave yields that were not significantly different from those of Panses de Brochets.

Of the Pont de Pierre strains tested in 1936 none was significantly better than the control. In the two following years, however, Chivers' Pont de Pierre gave yields that were very significantly higher than the control. In these two seasons its average yield was 18 per cent. higher than the control, while over the three year period its yield was nearly 11 per cent. higher.

DRY MATTER CONTENT.

Table II gives the dry matter content of the strains at each sampling date, the average for each season, and the general average over the three years. The average dry matter content of all the strains taken together shows but little change between the first and last samples in 1936 and 1937 when conditions of growth were normal. In 1938, however, the large fall in dry matter content shown by each strain at the last sampling is remarkable. The growth conditions in that season were very abnormal, as already mentioned under " The 1938 trials ", and it is possible that the fall in dry matter may be due to the severe frosts which occurred between the two dates of sampling.

Panses de Brochets and La Productive each had a lower dry matter content than the control, and were indeed closely similar to each other in this respect. Magdeburg—grown in 1936 only—was also comparatively low in dry matter. The Pont de Pierre stocks had similar dry matter contents to the control, though on the whole their figures were slightly lower. Vilmorin's Half-long had by far the highest dry matter content, but its yield of roots was extremely poor.

DRY WEIGHT CHICORY YIELDS.

In Table III the estimated dry weight yield of roots is given in tons per acre, and as a percentage of the control. This estimate is based upon the dry matter at the final sampling date (given in the same table) related to the yield of washed roots.

In the 1936 trial the whole produce of the plots, after being washed, was kiln-dried under similar conditions. These conditions were such that the drying was carried to a much further stage than is usual with commercially once-dried chicory (which usually contains about 15 per cent. of moisture) so that the final material closely approached the anhydrous state. The actual dry weight yield per acre obtained in this way is given in Table IV and, alongside for comparison, the dry weight yield estimated on the same basis as the figures in Table III. The estimated yields are in fact very close to the yields obtained by drying and weighing the whole produce, and show that the figures in Table III may be taken as approximately correct.

On an average of the three seasons Chivers' Pont de Pierre gave a dry weight yield five per cent. higher than the control and eight per cent. higher than Panses de Brochets. The latter strain gave almost exactly the same dry weight yield as La Productive over the two years when they were grown together.

INDIVIDUAL ROOT WEIGHT.

The average root weight in pounds at each sampling date is given in Table V. Owing to the small number of roots comprising each sample it is undesirable to base conclusions on the individual samples as to progressive changes in the root weights. The average weight of the total number of roots sampled in each season of any strain may, however, be taken as a reliable comparative figure. The average root weight of all strains affords some evidence that when the crop is sown at a normal date, i.e. by the middle of May, the maximum root weight may be reached by November, or perhaps even earlier.

The low root weight of the Half-long strains is noticeable; Chivers' Half-long was only equal to 89·7 per cent. of the control in 1936, and Vilmorin's Half-long only equal to 82·7 per cent. of the control in 1937.

Panses de Brochets and La Productive both had root weights considerably higher than the control and similar to each other. The general average root weight over the three years of Panses de Brochet was 24 per cent. higher than the control, while on the same comparison Chivers' Pont de Pierre had roots eight per cent. heavier than the control.

ROASTING AND EXTRACTION TESTS.

The produce of the 1936 plots, after being dried by Messrs. Chicory Limited, was submitted to Messrs. J. Lyons & Co. Ltd., who kindly undertook to make a laboratory examination of each strain to determine its relative commercial value. The samples were sent under code numbers and compared with a standard chicory in the laboratory.

From the factory point of view the most economical chicory is that which gives its best flavour, maximum colour and maximum percentage of soluble extractives in the shortest time of roasting, i.e. so that the least amount of loss by decomposition occurs.

Each of the chicories was submitted to a chemical examination before and after roasting to ascertain the yield and quality of the roasted chicory obtainable from it, and the optimum conditions of roasting required.

From the results obtained it was concluded that the most economical chicories from the factory point of view were Pont de Pierre (English), Magdeburg (Belgium) and Half-long (Chivers'). The strains Panses de Brochets did not appear to be very useful from the factory point of view, while the Belgium Pont de Pierre was a milky chicory which did not appear to roast well. Chivers' Pont de Pierre was not so useful from the point of view of yield of extractives as the three strains mentioned above.

REVIEW OF THE STRAINS.

Magdeburg (also known as Chicorée à café longue de Brabant)—grown from Belgian seed from the firm of V. Soenen - Vandamme, Roulers, Belgium.

The roots were spindle shaped (Fig. B), long, and tapering towards the top as well as below. They were fairly constant in shape, but rather brittle. Owing to their great length — often 12-16 inches — they were difficult to lift and many roots were broken in the process. The leaves were of medium size, with almost entire margins, and remained green to a late date.

This produced a high yield of roots, and a dry weight yield almost equal to the control Pont de Pierre. The dry matter content of the root was below the control, but it was one of the best from the roasting point of view. Because of the great difficulty in lifting this strain it was not tested after 1936.

Half-long, grown from French seed supplied by Messrs. Chivers & Sons, Ltd.

This was a very distinct type with deeply indented leaves like those of the dandelion. The leaves were of medium size and appeared to be more susceptible to frost than those of the other varieties. The roots were of constant shape — a rather long narrow and tapering cone (Fig. F). They were easy to lift and few breakages occurred. Its root yield was significantly lower than the control, but its percentage of dry matter was equally good, and it was one of the best strains from the roasting standpoint.

Seed of *Vilmorin's La plus riche* Half-long strain (Silesian type) from Messrs. Vilmorin et Cie, Paris, was used in the 1937 trial. This differed in several respects from the Half-long strain grown in 1936. It had smaller leaves — the smallest of any strain — and they were long, narrow, and on the majority of plants the margins were entire. The roots were similar in general shape to the Half-long strain of the previous season, but at the time of lifting a large proportion of them were split or cracked longitudinally towards the crown, and a corky tissue — possibly a kind of callus growth — was present on the damaged parts. Numerous lateral fibrous roots were present, and the strain appeared to be later maturing than the rest. Its yield of roots was extremely poor — the lowest of any strain — but it had by far the highest dry matter content.

The Half-long strains are easy to lift, and appear to be of good quality for both drying and roasting, but their very inferior yields are a serious drawback from the grower's point of view.

Panses de Brochets (Belgian seed from V. Soenen - Vandamme).

This strain had small tops, and the leaf stalks were less coarse than in the other strains, and the leaves paler in colour. The crowns of the roots frequently stood well above the ground level, and the roots themselves were long, stout, and tapered slowly towards the base. They were invariably heavy roots and reasonably uniform in shape (Fig. C).

This strain gave very high root yields, but its dry matter percentage was low, and its average dried weight yield was slightly below the control. From the roasting standpoint it did not appear to be an economical strain, and although it is of the heaviest yielding type its roots are somewhat difficult to lift and easily broken.

La Productive (French seed from Messrs. Vilmorin et Cie, Paris).

This was said to be an improved type of Panses de Brochets and was therefore compared with that strain in 1937 and 1938. It produced rather more leaf than Panses de Brochets and its leaves were strikingly broad. Its roots were of uniform shape, usually shorter than those of Panses de Brochets, and their weight appeared to be centred nearer to the crown (Fig. P). In yield of roots, dry matter content, and dry weight yield these two strains were closely similar. In view of its shorter root, however, La Productive appears to be the better from the grower's standpoint. As this strain was not grown in 1936 no roasting results are available.

Pont de Pierre (the control strain) (Belgian seed from Messrs. V. Soenen - Vandamme).

This appears to be identical with the type known in France as Dunkerque. It was a vigorous grower, with large erect leaves, often 18 inches high, and of a dark green colour. Its roots were clean, white and of a fairly long cone shape, very uniform to type (Fig. A).

It proved to be a useful control as it gave high root yields and had a higher dry matter content than all others excepting the Half-long strains. Its average dry weight yield was better than all others excepting Chivers' Pont de Pierre. On the other hand it did not appear to roast well.

Pont de Pierre (French seed supplied by Messrs. Chivers & Sons, Ltd.).

This appeared to be the most vigorous in growth of all the strains tested. Its leaves were very large, of a very dark green colour, erect in habit, and frequently 20 inches or more in height. Its root shape was similar to that of the Belgian Pont de Pierre but inclined to be rather longer. Its average root yield was almost 11 per cent. higher than the control, but its average dry matter content was about one per cent. lower, so that its dry weight yield was only some 5 per cent. higher than the control. From the roasting point of view this particular strain was not liked so well as the Magdeburg or Half-long strains, though actually another Pont de Pierre strain was considered to be the best.

The other two stocks of Pont de Pierre (English-grown seed 1933 crop and English-grown seed 1935 crop) supplied by Messrs. Chivers & Sons were included in the 1936 trials partly to compare English-grown seed with continental, and partly to see if any differences were shown in the tendency to bolt between stocks of old and new seed. Actually the number of bolting plants in any of the strains was negligible; and to test this feature the sowing would have to be much earlier than was the case in this trial.

In leaf characters and root shape the two English-grown Pont de Pierre stocks were like the control, though the 1933 seed produced a less uniform

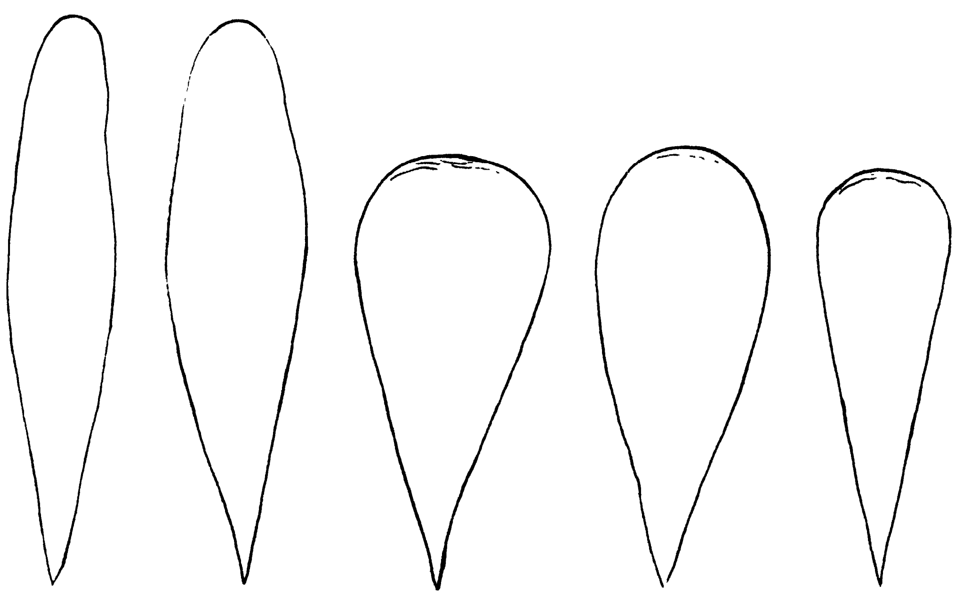
root-shape. The 1933 seed also gave a lower root yield than the control and a much lower dry weight yield of roots.

The English-grown 1935 seed gave a similar root yield to the control but a lower dry weight yield. This stock was judged to be the best of the chicories grown in 1936 from the factory point of view and by its yield of extractives after roasting.

The *Pont de Pierre* type yields a high tonnage of roots to the grower and, on account of its relatively short cone-shaped root, is easier to lift and freer from breakage than most other types. For the same reason it should be more suitable for growing on stiffer soils than the long-rooted types. The best strains of this type have a satisfactory dry matter content, and give high dry weight yields per acre.

The ideal strain of chicory would be one that gave the highest yield to the grower, the highest percentage return to the dryer, and in addition the best quantitative and qualitative results on roasting. It is obvious that all these qualities are unlikely to be found combined in any one strain. Taking all the factors into consideration, however, it appears that in this country strains of the Pont de Pierre type on the whole best fulfil the varied requirements of the grower, the dryer, and the roaster of chicory.

The thanks of the Institute are due to those who rendered assistance with these trials, especially to Messrs. Chicory Limited, and also to Messrs. J. Lyons & Co. Ltd. for making the roasting tests.



SHAPE OF TYPICAL ROOTS OF CHICORY STRAINS TESTED.

Fig. A. Pont de Pierre.
B. Magdeburg.
C. Panses de Brochets.
P. La Productive (Vilmorin's)
F. Half-Long.

The figures are reduced to approximately one-fourth of the natural size.

Table I.

CHICORY TRIALS, OXLODE, ISLE OF ELY, 1936-1938.

Yields of washed roots (Raw Chicory to the Dryer).

Strain	Washed root yields.							
	Tons per acre.				Expressed as a percentage of the control			
	1936	1937	1938	Average 1936-38	1936	1937	1938	Average 1936-38
Pont de Pierre (Belgian) (control)	15·1	16·57	9·67	**13·78**	100·0	100·0	100·0	**100·0**
Pont de Pierre (Chivers') (French)	14·5	19·75	11·36	**15·20**	96·0	119·0	117·0	**110·7**
Panses de Brochets (Belgian) ...	18·7	18·75	9·63	**15·70**	124·0	113·0	100·0	**112·3**
La Productive (Vilmorin's) (French)	—	18·32	9·98	—	—	111·0	103·0	—
Magdeburg (Belgian)	16·4	—	—	—	108·0	—	—	—
Half-Long (Chivers') (French) ...	13·9	—	—	—	92·0	—	—	—
Half-Long (Vilmorin's) (French) .	—	10·44	—	—	—	63·0	—	—
Pont de Pierre (English-grown, 1935 crop)	15·3	—	—	—	101·0	—	—	—
Pont de Pierre (English-grown, 1933 crop)	13·8	—	—	—	92·0	—	—	—
Standard Error (Tons per acre) ...	0·2	0·17	0·16	—	—	—	—	—
Significant difference (Tons per acre)	0·7	0·56	0·54	—	—	—	—	—

Table II.

CHICORY TRIALS, OXLODE, ISLE OF ELY, 1936-1938.

Dry matter content of roots at each date of sampling (24 roots per sample), and average dry matter content of all samples taken.

Strain	1936						1937					1938			1936–38
	5th Oct.	19th Oct.	2nd Nov.	16th Nov.	30th Nov.	Average	18th Oct.	1st Nov.	15th Nov.	29th Nov.	Average	5th Dec.	10th Jan. 1939	Average	General average
Pont de Pierre (Belgian) (control)	21·2	21·9	21·5	22·9	22·9	**22·1**	24·6	23·2	23·7	23·2	**23·7**	21·4	18·7	**20·0**	**22·3**
Pont de Pierre (Chivers') (French)	21·6	23·0	21·6	22·4	23·7	**22·5**	21·9	21·4	21·9	22·0	**21·8**	21·9	16·4	**19·1**	**21·6**
Panses de Brochets (Belgian) . .	21·2	21·0	19·1	19·5	19·0	**20·0**	22·9	21·9	20·8	20·3	**21·5**	20·8	16·8	**18·8**	**20·3**
La Productive (Vilmorin's) (French)	—	—	—	—	—	—	21·1	20·8	21·3	21·3	**21·1**	20·1	15·6	**17·9**	—
Magdeburg (Belgian)	19·8	22·7	20·4	19·8	20·6	**20·7**	—	—	—	—	—	—	—	—	—
Half-Long (Chivers') (French) ...	21·8	23·2	19·8	23·5	23·2	**22·3**	—	—	—	—	—	—	—	—	—
Half-Long (Vilmorin's) (French)	—	—	—	—	—	—	28·2	28·6	27·6	27·6	**28·0**	—	—	—	—
Pont de Pierre (English-grown, 1935 crop)	22·6	23·2	19·8	22·4	21·4	**21·9**	—	—	—	—	—	—	—	—	—
Pont de Pierre (English-grown, 1933 crop)	20·4	22·6	20·3	22·4	23·0	**21·7**	—	—	—	—	—	—	—	—	—
Average of all strains	21·2	22·5	20·3	21·8	22·0	—	23·7	23·2	23·1	22·9	—	21·0	16·9	—	—

Table III.

CHICORY TRIALS, OXLODE, ISLE OF ELY, 1936-1938.

Dry matter content of roots at last sampling date (just previous to lifting), and estimated dry weight yield of roots based thereon.

Strain	Percentage dry matter in roots				Estimated dry weight yield of roots							
					Tons per acre.				Expressed as a percentage of the control			
	1936	1937	1938	Average 1936–38	1936	1937	1938	Average 1936–38	1936	1937	1938	Average 1936–38
Pont de Pierre (Belgian) (control)	22·9	23·2	18·7	**21·6**	3·46	3·84	1·81	**3·04**	100·0	100·0	100·0	**100·0**
Pont de Pierre (Chivers') (French)	23·7	22·0	16·4	**20·7**	3·44	4·35	1·86	**3·22**	99·4	113·2	102·7	**105·1**
Panses de Brochets (Belgian) ..	19·0	20·3	16·8	**18·7**	3·55	3·81	1·62	**2·99**	102·6	99·2	89·5	**97·1**
La Productive (Vilmorin's) (French)	—	21·3	15·6	—	—	3·90	1·56	—	—	101·5	86·2	—
Magdeburg (Belgian)	20·6	—	—	—	3·38	—	—	—	97·7	—	—	—
Half-Long (Chivers') (French) ..	23·2	—	—	—	3·22	—	—	—	93·1	—	—	—
Half-Long (Vilmorin's) (French) .	—	27·6	—	—	—	2·88	—	—	—	75·0	—	—
Pont de Pierre (English-grown, 1935 crop)	21·4	—	—	—	3·27	—	—	—	94·5	—	—	—
Pont de Pierre (English-grown, 1933 crop)	23·0	—	—	—	3·17	—	—	—	91·6	—	—	—

Table IV.

CHICORY TRIALS, OXLODE, ISLE OF ELY, 1936-1938.

Comparison of *actual* dry weight yields with *estimated* dry weight yields of chicories in the 1936 trial.

Strain	(a) Actual total yield of washed roots from the trial plots	(b) Actual total yield of kiln-dried roots obtained from weights in column (a)	(c) Actual dry weight yield per acre based on weights in column (b)	(d) Estimated dry weight yield per acre based on dry matter percentage as shown in Table III	(e) Difference between actual and estimated dry weight yield per acre
	lbs.	lbs.	Tons	Tons	Tons
Pont de Pierre (Belgian) (control)	2705	614	3·43	3·46	-0·03
Pont de Pierre (Chivers') (French)	2600	599	3·34	3·44	-0·10
Panses de Brochets (Belgian) ...	3348	643	3·59	3·55	+0·04
Magdeburg (Belgian)	2929	609	3·40	3·38	+0·02
Half-Long (Chivers') (French) ..	2484	568	3·17	3·22	-0·05
Pont de Pierre (English-grown, 1935 crop)	2734	566	3·16	3·27	-0·11
Pont de Pierre (English-grown, 1933 crop)	2476	531	2·96	3·17	-0·21

Table V.

CHICORY TRIALS, OXLODE, ISLE OF ELY, 1936-1938.

Weight in lb. of individual roots (washed) at each date of sampling (24 roots per sample), and average root weight of all samples taken.

Strain	1936						1937					1938			1936-38
	5th Oct.	19th Oct.	2nd Nov.	16th Nov.	30th Nov.	Average	18th Oct.	1st Nov.	15th Nov.	29th Nov.	Average	5th Dec.	10th Jan. 1939	Average	General average
Pont de Pierre (Belgian) (control)	·377	·500	·543	·451	·466	**·467**	·632	·522	·604	·651	**·602**	·447	·484	**·466**	**·516**
Pont de Pierre (Chivers') (French)	·370	·474	·505	·464	·354	**·433**	·688	·628	·751	·787	**·713**	·536	·583	**·560**	**·558**
Panses de Brochets (Belgian) ...	·604	·700	·625	·644	·560	**·627**	·708	·724	·784	·724	**·735**	·536	·446	**·491**	**·641**
La Productive (Vilmorin's) (French)	—	—	—	—	—	—	·698	·677	·792	·662	**·707**	·505	·474	**·490**	—
Magdeburg (Belgian)	·430	·594	·531	·546	·521	**·524**	—	—	—	—	—	—	—	—	—
Half-Long (Chivers') (French) ...	·312	·458	·464	·447	·420	**·420**	—	—	—	—	—	—	—	—	—
Half-Long (Vilmorin's) (French) .	—	—	—	—	—	—	·469	·558	·466	·501	**·498**	—	—	—	—
Pont de Pierre (English-grown, 1935 crop)	·404	·557	·479	·567	·495	**·500**	—	—	—	—	—	—	—	—	—
Pont de Pierre (English-grown, 1933 crop)	·375	·461	·484	·475	·437	**·446**	—	—	—	—	—	—	—	—	—
Average of all strains	·410	·535	·519	·513	·405	—	·639	·622	·679	·665	—	·506	·497	—	—

REPORT ON THE QUALITY—
FOR BREAD-MAKING PURPOSES—OF WHEATS
HARVESTED IN 1938

AT THE HEADQUARTERS AND SUB-STATIONS OF THE NATIONAL INSTITUTE OF AGRICULTURAL BOTANY.

The wheats examined were the following:—

High Farming Trials: Cambridge, Cannington and Newport mixed.

KEY NO.		
1.	Yeoman II	Intensive manuring
2.	,, ,,	Normal ,,
3.	Juliana	Intensive ,,
4.	,,	Normal ,,
5.	190/101	Intensive ,,
6.	,,	Normal ,,
7.	202 (47B)	Intensive ,,
8.	,,	Normal ,,
9.	Desprez 80 (Joncquois)	Intensive ,,
10.	,, ,, ,,	Normal ,,
11.	Squarehead's Master	Intensive ,,
12.	,, ,,	Normal ,,

Fen Trial: (Littleport) unmixed.

13. Yeoman II
14. Juliana
15. Desprez 80 (Joncquois)
16. 190/101
17. 202 (47B)
18. Squarehead's II

From Randomized Strip Trial: Cambridge and Sprowston mixed.

19. 198 (20C)
20. 55/10/2C
21. Squarehead's Master (Control)

SPRING SOWN WHEATS.

Strip Trials: Newport.

22.	Atle	Unmixed
23.	Extra Kolben II	,,
24.	Blanka	,,
25.	Red Marvel (Control)	equal parts from the three trials above.

SUMMARY.

None of the wheats in this year's trials had baking characters at all comparable with those of average commercial bakers' flours.

Any attempt at placing the wheats in order of strength is complicated by the fact that dough handling characters—spring, in particular—gave no indication of the type of bread the flour produced and that the blending value of these English wheat flours again could not be inferred from the characters of the dough or bread the flours produced when baked alone.

Taking first the baking characters of the flours when baked alone, Yeoman II (Nos. 1 & 2) of the " high farming " trials had about the best all-round strength, followed closely by Desprez 80. Red Marvel (No. 25) had inferior dough characters but made bread about as good as Yeoman II and Desprez 80.

Yeoman II and Desprez 80 were also placed highest in the 1937 crop series, excluding Holdfast, of which no samples were sent this year. Their strength has however distinctly deteriorated between 1937 and 1938.

The rest of the series can only be described as mediocre to poor.

The three varieties which are new as regards this series of tests—Atle, Extra Kolben II and Blanka—are poor in dough handling characters but give fair bread.

The baking characters of blends of these flours, in the proportions of 40 to 60%, into flour from high grade Manitoba wheats, however told a different story.

While the dough handling properties of such blends appeared to be the simple averages of those of the component flours, the characters of the bread were not.

In the majority of cases there was no difference in the external appearances of the bread, whatever the relative proportions of English and Manitoba, over quite a wide range of such proportions, and not much more in crumb properties, and the bread was quite satisfactory over that range. This appears to be a characteristic property of Manitoba — English blends, and was found to apply to most of this series of flours : Juliana (No. 14), Squarehead's II (No. 18), 198/20C (No. 19) and Squarehead's Master (No. 11) were exceptional and showed inferior blending value to the rest, Desprez 80 (No. 9) being only a little better.

With these exceptions the blending values of these wheats may be considered quite satisfactory and there is no great difference between them, the water absorption of the blends, which is determined by the water absorption of the English wheat flour, then becoming the deciding factor.

In the " high farming " series of trials there seemed to be no significant difference between the baking characters of the flours from the intensively and normally manured wheats, when baked alone.

Those from the intensively manured wheats had a slightly higher water absorption than those from the normally manured with the exception of 190/101. This connection may be fortuitous : it was not found in the corresponding series harvested in 1937. The blending value of the flours from the intensively manured wheats was appreciably worse than that of the flours from the normally manured wheats in the cases of Desprez 80 (Nos. 9 and 10)

and Squarehead's Master (Nos. 11 and 12) : as regards the other wheats there was no such difference.

The same varieties of wheats as were used in the high farming trials were also grown in the Fen district at Littleport. The Fen grown wheats were not consistently different from the others in baking strength, Yeoman II and Desprez 80 being worse while 202/47B and Squarehead's Master were rather better.

The intensively manured wheats had generally higher protein contents and a higher proportion of translucent grains than the normally manured, while the corresponding Fen grown wheats were still higher in both respects.

Apart from protein content, analytical factors showed no variations corresponding to variations in cultural conditions.

EXTERNAL CHARACTERS OF THE WHEATS.

Most of these samples are what are described in the milling and grain trades as "red" wheats: only three are "white" wheats — Juliana, 198 (20C) and Blanka. All show quite a high degree of uniformity as regards this skin colour factor.

They are far less uniform in endosperm character, many consisting of mixtures of translucent and starchy grains, often with a fair proportion of mottled grains showing starchy and translucent patches. Yeoman II (No. 13) consists mostly of translucent grains, while Nos. 22, 23 and 25 — Atle, Extra Kolben II and Red Marvel — and all the White wheats, are almost entirely starchy.

In the High Farming Trial wheats, the effect of intensive as against normal manuring seemed to be generally to increase the proportion of translucent kernels, and the same wheats grown in the Fen district show a much more marked tendency in the same direction. In these cases protein content almost invariably increased with increasing translucency.

As will be seen later, there was no connection between the proportion of translucent grains in a wheat and its baking value.

Much more important to the miller is the uniformity of the size of the grains, which is dealt with under the heading—Laboratory milling process : screening. None of the samples showed any abnormality in this respect worth mentioning.

The general condition of the samples was good, only 190/101 (No. 16) containing a few sprouted and damaged grains. As a matter of interest, the external characters of the three varieties not previously met with in these trials may be mentioned.

Atle is a red wheat, largely starchy, the grains being of about average size for English grown wheats but rather broad in proportion to their length.

Extra Kolben II is a red wheat, largely starchy, rather smaller and more elongated than average English wheat types, and varying a fair amount in size.

Blanka is a white, almost entirely starchy wheat, fairly uniform in size but rather smaller than average English-grown wheat.

LABORATORY MILLING PROCESS.

(1) *Screening.*

The laboratory screenings plant being entirely mechanically operated and utilising the same processes as a commercial plant gives an opportunity of observing two points of commercial importance. First, whether the wheat contains grains large enough to be rejected along with barley and/or oats, and secondly, whether it contains grains which are small but perfectly formed and therefore come out with the seeds, though they are good enough to go on to the mill.

Actually none of these wheats showed any significant content of either type of grain.

The screenings were of the usual miscellaneous character, consisting of broken and shrivelled wheat, dust, chaff, wild oats and weed seeds, chiefly bindweed. The total screenings extraction varied between 0·2 and 2·0%, the four spring sown wheats from Newport containing from 0·8 to 2·0%, almost entirely bindweed.

(2) *Conditioning.*

The wheats being mostly damp were not washed but were given a thorough scouring on the laboratory cleaning plant and dried in a current of warm air at about 130°F. They were dried down to moisture contents which were higher the higher the proportion of translucent grains, as it is a fairly safe generalisation to say that the higher the proportion of such grains, the higher is the moisture content at which the wheat can be milled without difficulty. Yeoman II (No. 13) with a high proportion of translucent grains was conditioned to 17% moisture content while at the other extreme the starchy white wheats such as Juliana (Nos. 3 & 4) and Blanka (No. 24) were dried down to 15%.

(3) *Milling.*

Yeoman II (No. 13) was undoubtedly the best milling wheat as judged by the size and cleanness of the bran flakes and the ease with which the reduction stocks could be ground and dressed. It gave the highest flour extraction of the whole series — 70·7% based on total products.

Extra Kolben II (No. 23) was a little inferior in milling character but gave a satisfactory flour extraction — 68·3%.

55/10/2C (No. 20) and Atle (No. 22) came next; both gave 68·4% extraction. Next comes a rather large group which gave more difficulty in handling the reduction stocks, but which with due care gave good or reasonably good extractions : viz.

Yeoman II No. 1	68·2%
,, ,, No. 2	70·0%
Juliana No. 3	70·0%
,, No. 4	69·0%
,, No. 14	69·0%
190/101 No. 5	68·5%
,, No. 6	63·5%
,, No. 16	67·2%
202 (47B) No. 7	68·3%
198 (20C) No. 19	67·1%
S.H.M. No. 21	66·1%

190/101 (No. 6) was exceptional: the reduction stocks milled fairly well, but the bran broke up rather badly and did not clean well.

A further group required still more careful milling, giving fairly good to lowish extractions: viz.

Red Marvel	No. 25	66·1%
202 (47B)	No. 8	68·0%
Desprez 80	No. 9	67·0%
,,	No. 10	65·0%
S.H.M.	No. 11	66·9%
202 (47B)	No. 17	65·5%

The worst milling samples were

S.H.M.	No. 12	65·5%
Desprez 80	No. 15	65·2%
Squarehead's II	No. 18	64·1%

There is a suggestion from the above placing that variety governs milling characters more than does difference in cultural conditions; thus Yeoman II, Juliana, and 190/101 occupy high positions no matter where grown, and the Squarehead's Master samples come low in the list.

ANALYTICAL AND OTHER DATA.

Bushel Weight.

The figures are generally rather high in view of the somewhat high moisture contents. The wheats from the intensively manured plots in the high farming series are all rather higher in bushel weight than those from the normally manured plots.

Protein Contents.

These are higher—with one exception, 202 (47B)—in the wheats from the intensively manured plots than in those from the plots normally manured. They are invariably still higher in corresponding wheats grown in the Fen district. There is no connection between baking characters in general, and protein content.

Ash Contents.

May be considered normal for laboratory milled straight run flours from English-grown wheats.

The figures show no interesting features.

Maltose figures.

Normal to low. See also under heading — comparison between 1937 and 1938 crop wheats.

Gas Production in fermentation.

Quite high in Yeoman II Nos. 1 and 2 where the maltose figure is also the highest of the whole series: moderate to low or very low in the remainder with no definite connection with the maltose figure.

Flour Colour (See Table II) measured by means of the Lovibond Tinto-

meter as described in last year's report, dated 22nd April, 1938. Very satisfactory in every case as judged by the standards set by well-milled commercial baker's flours. Only the figures for the wetted flour surface when the wet gloss has just dried off need be given. The colour of the surface is deepest at this stage.

Extra Kolben II and Blanka are very lightly pigmented, i.e. are distinctly whiter than even a commercial short patent of high reputation.

Of the rest, even the flours from Yeoman II and 190/101, which are rather deeper in the red colour constituent than the rest, are equal to a good London made + 2/- patent.

Juliana and 202/47B and Squarehead's Master give yellower flours than the rest. The white wheats give flours with rather less red component than the red wheats on the whole.

Flour colour seems to be governed by variety of wheat and not at all by cultural conditions.

BAKING TESTS.

Two chief methods of testing were used.

(1) Fermenting for 3¼ hours at 80°F (at the start) with 2% yeast and adding 2% cane sugar at dough-making, an amount of sugar which tests showed was quite sufficient to supply adequate gassing power during the proving period.

Two doughs were made from each flour : in making the first, liquor was gradually added until the baker judged that the quantity was as much as the flour could comfortably carry to give a satisfactory consistency.

As the doughs from English wheat flours are apt to soften during fermentation, a second dough was then made up using liquor at the rate of one gallon per sack less than that given in the first case. The pairs of doughs were handled side by side and baked in the same oven.

During fermentation observations were made on the characters of the doughs when moulded : extensibility and spring, and the "body" of the dough which is largely if not entirely governed by the amount of liquor given at making.

In assessing the characters of the bread, attention is paid to the volume of the loaf, crust characters, and the feel, grain and texture of the crumb.

In the second method, the English wheat flours were blended into a straight run flour made from all Manitoba wheats at the rates of 40, 50, and 60% of the English flours. The doughs were made up with an amount of liquor averaging 15 galls. per sack, being varied as indicated by the first test : 2% yeast and 2% sugar were used, all the doughs being fermented for 3¼ hours in all.

Observations were again made during the fermentation process on the characters of the doughs when moulded and on the volume and crust and crumb characters of the loaves.

The results of some additional baking tests will presently be described : they were made to obtain further information on some anomalies noted during these first tests.

Method of assessing baking characters.

In drawing conclusions from these observations it is only possible to make quite broad generalizations, for the reason that little connection is traceable with these flours between handling of dough, and bread characters, either external or internal, and blending value. To illustrate this latter point Table No. III has been compiled. Dough handling and bread characters and also blending values have been awarded " points " which are higher the greater the degree of excellence shown by the particular character, and the system by which the points have been assessed is as follows.

The figures only apply to the present series of flours : they are merely relative and have no reference to flours in general. The handling of the dough is judged by its springiness when being moulded at scaling time : as a rule good spring is accompanied by good extensibility, but this is not invariably the case.

Size of bread is assessed by the height of the loaf, which, again may give a different measure of size than actual measured volume. The height of the loaf probably gives a satisfactory idea of its size as judged by the eye.

Crust character is judged by giving the highest score to a smooth unbroken crust and lower scores as the crust becomes more short and ragged.

Crumb character is marked according to fineness and evenness of grain and also according to its spring, a dense cheesy crumb having the lowest score. In judging crumb character no very strict placing can be attempted ; in one case grain may be even but coarse or open, in another even and fine but too close.

Blending value is judged by the maximum amount of the English wheat flour which can be blended with the Manitoba wheat flour to produce a dough which handles sufficiently well as compared with average commercial bread flours, and a loaf of similar general characters to that produced from such commercial flours when baked by our laboratory process. Here again there must be a good deal of latitude in making a decision, for blends of English and Manitoba flours only, in any proportions, do not as a rule give bread resembling in all respects that made from commercial bread flours, which are made from a mixture of several different types of wheat.

This table will be useful in saving a good deal of written description. The absorption figures have been added to complete the story : they represent the number of gallons of yeast-salt liquor per sack of flour which the flours will comfortably take to give doughs of average body at the scaling period. They have been corrected to a common basis of 15% moisture content of the flours.

Difficulties in such assessment.

The markings awarded to the three samples of Yeoman II (Nos. 1, 2, and 13) illustrate the difficulties of placing these flours in any definite order of baking value.

No. 13 was easily the best as regards dough handling, the dough being quite extensible with fairly good spring, approaching but by no means equalling an average straight run baker's flour in these characters and being quite the best of the whole series. It gave a small loaf having a smooth unbroken

crust and the properties of the crumb were only mediocre — grain being fairly even, rather coarse in the centre of the loaf with poor honeycomb-like vesiculation and with a dense rubber-like feel.

No. 1 handled much worse than No. 13, but gave a loaf of much better volume, though with rather short crust, and the crumb was much better in every respect than that from 13.

No. 2 was fairly similar on the whole to No. 1, but perhaps slightly inferior. Like No. 1 it handled distinctly worse than No. 13, but made decidedly better bread.

As regards blending value, the baker could find no difference in the handling of corresponding blends from the three flours, the superiority of No. 13 being imperceptible when each was blended with approximately its own weight of Manitoba flour.

There was no difference in volume or crust characters in the loaves from the three blends of Nos. 1 and 2 and not much in crumb characters, the crumb becoming slightly more open in grain and a little harsher in feel with increasing proportions of English flour. The blending values of these flours are therefore rated high.

In the loaves from the three blends of No. 13 there was not much difference in the loaves from 40 to 50% blends in any respect, both, like all those from Nos. 1 and 2, being equal to the bread from average baker's flours. But the loaf from the 60% blend was much inferior in all respects and the blending value of No. 13 has been given a lower rating.

Blending value as indicated by dough and bread characters.

The last seven of the set, Nos. 19 to 25, all had poor dough handling characters, extensibility and spring being poor to very poor. The loaves varied a fair amount in size from rather poor to very good : crust characters with one exception—No. 19, which gave a very broken "flying" crust—were fairly good to good, and crumb properties were on the whole reasonably good—again with two exceptions, Nos. 20 to 21, where the crumb was close and rubbery with poor vesiculation. Yet all blended well with Manitoba, the defects shown by the bread from the flours baked alone largely disappearing in the loaves from the blends, even those containing 60% of the English flour. No. 19 was an exception : the 40% blend from this flour was quite equal in all respects, dough handling and bread characters, to an average baker's flour, but the bread from the 50 and 60% blends fell off sharply in all respects. It will be clear from these remarks and from a study of the table that

(1) the handling properties of the doughs from these flours gave no idea of the characters of the bread produced, nor of their value for blending with Manitoba wheat flour. Handling properties certainly seem to be additive, that is, such properties in the case of blends of these English into Manitoba wheat flours are the simple average of the various handling characters of the English and Manitoba flour doughs when made up separately, according to the proportion of each flour in the blend.

(2) Blending value can only be determined by actually making up blends of English and Manitoba wheat flours and baking them, since the

character of the bread from the English wheat flour gives no sufficiently definite indication of the loaf characters of the blends.

It will be seen from the column under the heading " blending value " in the table that 19 of these flours are given a score of 4 to 5, which illustrates a point which has often been noted in baking tests made in these laboratories on blends of English and Manitoba wheat flour, that as much as 60% of an English wheat flour which baked by itself gives a poor loaf, can be blended with 40% of Manitoba wheat flour to give perfectly satisfactory bread.

General loaf characters are certainly not additive in the case of such blends. There are however marked exceptions to the rule which admit of no explanation.

Bread characters and conditions of Baking Methods.

Two groups of flours may be distinguished in this series which show anomalous behaviour, viz. a group with poor dough handling characters which nevertheless give bread of fair volume with short crust and fairly good crumb characters, such as Nos. 22 to 25, the other group comprising Nos. 13, 15, 16, 17 (all from the Fen trials set) giving good dough handling properties but small bread with smooth unbroken crusts and poor crumb characters.

The bread from these two types is illustrated in the photographs.

A variety of baking tests was made on these two types of flour to see whether any improvement could be made in the character of the bread from the second type so as to bring it more into line with the better dough-handling properties of these flours.

Three doughs were made up from members of the two groups with 2% yeast, but the doughs were fermented for 2¼, 3¼ and 4¼ hours in all, respectively, and given a thorough moulding at approximately ¾ hr. intervals from dough making.

Tests were also made on these flours using various improvers in various combinations, viz. a highly diastatic malt flour alone, and in combination with acid ammonium phosphate and with potassium bromate, which was also used alone.

In other experiments, the flours were fermented for 6 hours in all, with 0·75% yeast, and finally according to a short sponge and one-hour-dough method.

Briefly, the bread from these two classes of flours showed no appreciable variation from type as regards either external or crumb characters, in spite of these wide variations in fermentation process. The only change produced was that the flours of the Fen district group tended to lose their smooth unbroken crusts, which became shorter, when the doughs were fermented for 6 hours. Otherwise the bread from those flours was always small or rather small with poor crumb properties.

This curious intractability of bread characters to wide variations in fermentation process, in spite of fairly good dough handling properties, is remarkable, and admits of no explanation at present. It might be expected again that as the Fen Trial flours have reasonably high protein contents they would be more susceptible to the action of improvers and more drastic manipulation of the doughs, but such was not the case.

These observations tend to confirm the conclusions already drawn, that any relative superiority in dough handling character is not necessarily reflected in superiority in bread character, no matter how the baking process may be varied.

General baking characters of the series.

The general baking properties of the whole series may now be briefly discussed.

Yeoman II (No. 13) was the only flour showing any approach, but certainly not a close approach, in the handling of the dough to a commercial baker's flour, but the bread was poor and hopelessly inferior to bread from a baking flour, nor did it seem to have any potentialities for giving a satisfactory loaf, when baked alone : its blending value again was not high. The protein content was the highest of the whole set and equal to that of, for instance, many Plate wheats.

Yeoman II (Nos. 1 and 2) were distinctly inferior to the above in dough-handling but gave better bread and better blending value. There was no difference between the two.

These three Yeoman flours had the highest water absorbing powers of the whole set, though the 190/101 samples were almost as high.

The two samples of Desprez 80 (Nos. 9 and 10) came next to Yeoman II taking dough and bread characters as a whole : No. 9 rather curiously had decidedly worse blending value than No. 10.

Red Marvel (No. 25) must also be put high in the series in view of general bread characters and blending value, but its water absorption and dough properties were poor.

The rest of the series were merely mediocre to poor, as judged by behaviour when baked alone, though their blending values were mostly good.

The spring sown wheats, Nos. 22 to 25, which include the new varieties, gave flours with low water absorbing powers and which produced short doughs, lacking extensibility and spring : the bread however was of fairly good all-round character and blending value was quite satisfactory in all. All were starchy wheats with low protein content.

Effects of Cultural Conditions.

Taking the series Nos. 1 and 2 it does not appear that intensive as against normal manuring had any influence on general baking characters, except that in the cases of Desprez 80 and Squarehead's Master blending value was lower under intensive manurial conditions.

Nor can it be said that the same wheats grown in the Fen district showed any all-round better strength. These Littleport trial wheats only showed an appreciable improvement in dough-handling as compared with those grown in the High Farming Trials in the case of Yeoman II, with a trifling improvement in 190/101 and 202/47B : bread characters and blending value on the other hand showed a distinct falling off with Yeoman II and no change with the other two wheats. Crust characters improved markedly in Juliana and 202/47B, with no other change, crumb characters in general fell off decidedly in Desprez 80, and blending value was worse in Juliana and 190/101.

In the 1937 crop, Yeoman II grown in the Fens had much better all-round strength than when grown elsewhere under high farming conditions, but in the 1938 crop this was certainly not the case.

The stations at which the high farming trials were carried out were not the same in the two years, which naturally affects the comparison.

As already stated, the intensively manured wheats had higher protein content than the normally manured wheats, except only 202/47B, while the Fen grown wheats showed a further, still more marked increase in protein. Such increases in protein content have had no general beneficial influence on strength properties, a conclusion arrived at from the earlier work of the Home Grown Wheat Committee.

So also, the general increase in the proportion of translucent grains which accompanies this increase in protein content was not correlated with any change in baking characters.

Comparison between 1937 and 1938 Crop Wheats.

Several of these wheats figured in the series grown in 1937 (see that Committee's Report dated 22nd April 1938) and it will be of interest to see how the varieties grown under fairly comparable conditions in the two seasons have varied in baking properties.

The comparison is set out in Table IV from which it will be seen that there has been in general a falling off in baking characters from 1937 to 1938, most marked in the wheats ranking highest in 1937, though those wheats—Yeoman II and Desprez 80 still maintain their superiority over the rest.

The results for 55/10/2C are not strictly comparable, as the 1937 and 1938 samples were grown in different localities.

The figures for protein content, given in the table, show in the great majority of cases remarkably little change from one year to the next as regards either wheats or flours.

Variety of wheats has an influence on maltose figures in the sense that the figures for the wheats of the high farming trials are practically the same for the same wheat, whether intensively or normally manured, and are in the same order in the High Farming and in the Fen trials. The order of the maltose figures for the several varieties grown in the high farming trials is the same for the 1937 and 1938 crops.

The Research Association of British Flour Millers.

E. A. FISHER,

Director of Research.

April 5th, 1939.

APPENDIX.

Note on the baking characters of the Fen-grown wheats Nos. 13 to 18.

In the section headed " Bread characters and conditions of baking methods ", this statement was made—" this curious intractability of bread characters to wide variation in fermentation process [as regards the flours from these particular wheats] in spite of fairly good dough handling properties, is remarkable, and admits of no explanation at present " (p. 380).

Since this report was written, further baking tests on these flours have been made in which certain so-called chemical flour improvers have been added in proportions considerably higher than those generally used, and as a result very marked improvements in all bread characters have been obtained.

In some of the tests discussed in the report, potassium bromate was added to some of these flours before baking at the rate of 10 parts of bromate per million of flour. This very potent flour improver is used at that rate in the commercial improvement of flour in some countries, and is also used in that proportion in the Standard Baking Test specification officially adopted by the North American cereal chemists.

These earlier baking tests on the flours from the Fen grown wheats showed no improvement in the bread when potassium bromate had been added at the rate of 10 parts per million of flour, but in later tests the same improver added in proportions up to 40 parts per million caused great improvements in volume and outer appearance of the bread, and also in the grain and feel of the crumb.

This all-round improvement in bread characters was greater the higher the protein content and the better the dough-handling properties of the flour baked alone, being least therefore in No. 14 (Juliana) and greatest in No. 13 (Yeoman II).

Other flour improvers, including one which is in wide commercial use in this and other countries, gave similar marked all-round improvements in the bread, when relatively heavy doses of the improver were used.

It is clear that to get a correct idea of the bread-making potentialities of these wheats, their baking characters *after the flours have been treated with such improvers as may be used in commercial practice* must be investigated. In reporting on these home-grown wheats it has been usual, in the past, to limit the baking tests to the untreated flours, but it is suggested that in any future investigations the effects of such flour improvers as English flour millers habitually use should most certainly be examined.

The flours under discussion all gave quite extensible doughs and one characteristic effect of the particular improvers found to be so beneficial is to reduce extensibility appreciably. It seems likely that if such flours are to give good bread it is essential that this high extensibility be markedly reduced, which is probably the reason why relatively high doses of appropriate improvers are necessary to develop the full inherent strength of these flours.

On the other hand, flours whose doughs are insufficiently extensible (i.e., doughs showing " shortness ", which may be common some seasons) cannot be improved and may even be damaged by chemical treatment.

May 8th, 1939. E.A.F.

Table I.

ANALYTICAL AND OTHER DATA.

	WHEATS.			FLOURS.							
							GAS PRODUCTION.				
Ref. No.	Moisture Content %	Bushel weight (clean) lb.	Protein %	Protein %	Dry Gluten %	Maltose Figure	2nd hour	3rd hour	4th hour	5th hour	Ash Content
1	17·1	64	9·88	8·35	8·6	1·35	102	105	103	74	0·47
2	17·7	63	8·77	7·68	7·55	1·4	98	105	108	85	0·52
3	17·6	64·2	9·05	7·77	7·45	0·7	94	64	32	25	0·48
4	17·7	63	8·35	6·95	6·55	0·65	96	59	33	24	0·46
5	17·0	63·6	9·38	8·14	7·8	1·3	82	95	85	50	0·52
6	17·2	63·3	9·19	7·68	7·6	1·1	83	94	75	42	0·48
7	17·0	63	8·63	6·93	6·5	0·7	90	79	40	28	0·49
8	17·5	62	8·64	7·08	6·4	0·7	95	87	43	32	0·54
9	16·5	64·5	9·12	7·61	7·4	0·9	86	88	49	37	0·44
10	17·4	63·2	8·62	6·97	6·5	0·85	87	82	50	29	0·44
11	16·7	65·3	9·59	7·77	7·7	0·75	95	73	39	22	0·40
12	17·1	64·6	8·88	7·15	7·0	0·7	92	72	36	28	0·46
13	17·65	65	12·23	10·61	11·3	1·05	79	101	58	32	0·42
14	17·5	65	10·88	8·88	9·5	0·65	77	73	32	23	0·45
16	16·9	64	12·20	10·49	11·8	1·0	85	102	68	38	0·45
17	17·1	64·6	10·86	9·26	9·5	0·5	83	54	26	21	0·45
15	17·4	64	11·36	9·42	9·45	0·75	82	54	36	30	0·51
18	17·6	64	12·75	10·15	10·25	0·5	71	43	27	19	0·43
19	16·6	64·6	9·07	7·25	6·6	0·65	85	85	40	28	0·40
20	15·8	66·6	9·16	8·0	7·6	1·05	109	118	94	63	0·46
21	16·6	65·4	9·05	7·54	7·0	0·7	110	93	45	32	0·44
22	18·9	63·6	9·33	7·75	7·6	0·7	108	90	40	32	0·47
23	18·1	64·2	8·23	7·11	6·5	1·2	110	96	58	34	0·45
24	18·2	62	7·65	6·06	5·6	0·8	103	90	50	37	0·52
25	17·8	62·3	8·84	7·36	7·15	0·7	90	54	28	18	0·49

Table II.

COLOUR OF FLOUR : Lovibond tintometer measurements.

No.	Variety or type	Colour units red	Colour units yellow	Colour of wheat
1	Yeoman II	0·65	1·90	Red
2	,,	0·70	1·90	
13	,,	0·75	1·90	
5	190/101	0·65	1·90	
6	,,	0·70	1·90	
16	,,	0·70	1·90	
7	202/47B	0·55	2·00	
8	,,	0·60	2·00	
17	,,	0·60	2·00	
9	Desprez 80	0·60	1·90	
10	,,	0·60	1·90	
15	,,	0·65	2·00	
11	Squarehead's Master	0·55	2·00	
12	,,	0·60	2·00	
18	,,	0·60	2·00	
21	,,	0·55	2·10	
20	55/10/2C	0·65	1·90	
22	Atle	0·55	1·90	
23	Extra Kolben II	0·45	1·50	
25	Red Marvel	0·55	1·60	
3	Juliana	0·55	2·00	White
4	,,	0·55	2·00	
14	,,	0·50	2·10	
19	198/20C	0·50	2·00	
24	Blanka	0·40	1·50	
Commercial Short Patent (bleached)		0·63	1·70	
2/- Patent unbleached . .		0·71	2·15	
1/- ,, lightly bleached		0·86	1·90	

Table III.

Ref. No.	Variety	Absorption	Dough handling	Bread size	Bread crust	Crumb grain	Crumb spring	Blending value
1	Yeoman II	$15\frac{1}{4}$	2	4	3	5	4	5
2	,,	$14\frac{3}{4}$	2	3	5	4	3	4
3	Juliana	$14\frac{1}{4}$	2	3	2	2	2	5
4	,,	$13\frac{3}{4}$	2	4	1	2	2	5
5	190/101	15	2	1	5	2	1	5
6	,,	$15\frac{1}{4}$	2	2	4	2	1	4
7	202/47B	$14\frac{1}{2}$	2	3	1	1	1	5
8	,,	14	2	3	2	1	1	4
9	Desprez 80	13	3	4	4	4	3	2
10	,,	$12\frac{3}{4}$	3	4	4	4	3	5
11	Squarehead's Master	$14\frac{1}{2}$	3	2	2	5	1	1
12	,,	$13\frac{3}{4}$	3	3	4	2	2	5
13	Yeoman II	$15\frac{1}{4}$	4	2	5	3	2	3
14	Juliana	14	2	3	4	1	2	1
16	190/101	$14\frac{3}{4}$	3	2	5	1	2	5
17	202/47B	$14\frac{1}{2}$	3	2	5	1	1	4
15	Desprez 80	$14\frac{1}{2}$	3	3	5	1	1	5
18	Squarehead's Master	$14\frac{1}{4}$	3	3	5	2	3	1
19	198/20C	$14\frac{1}{4}$	2	4	1	4	3	1
20	55/10/2C	14	1	2	5	4	1	5
21	Squarehead's Master	$14\frac{1}{2}$	1	3	4	4	1	5
22	Atle	$13\frac{1}{2}$	1	4	4	3	3	5
23	Ex. Kolben	14	1	3	3	5	5	4
24	Blanka	$13\frac{3}{4}$	1	4	3	5	5	4
25	Red Marvel	$13\frac{3}{4}$	2	5	3	5	5	4

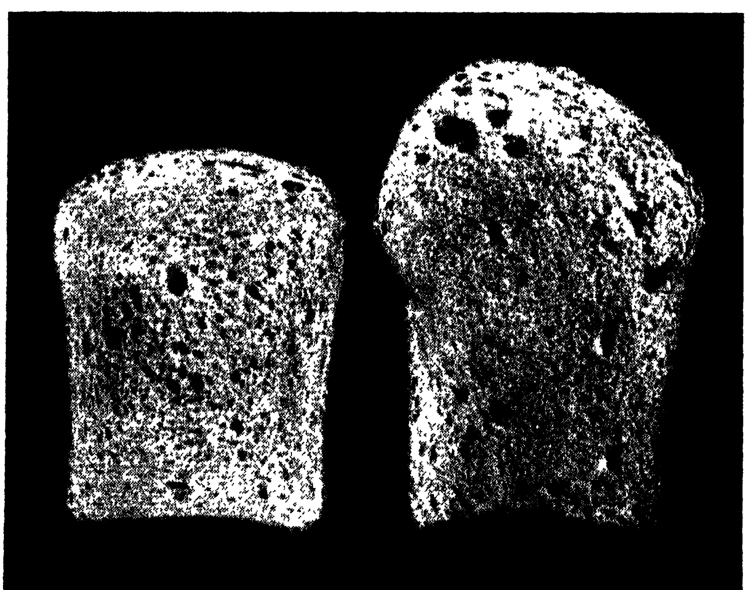
Table IV.

COMPARISON OF WHEATS GROWN IN 1937 AND 1938.

		Protein content				Maltose figure		Baking properties			
		Wheat		Flour				Water absorption		General	
		1937	1938	1937	1938	1937	1938	1937	1938	1937	1938
High Farming trials.											
Yeoman II	— intensive	9·32	9·88	8·13	8·35	1·90	1·35	15·0	15·2	good	fair
	normal	8·78	8·77	7·63	7·68	1·75	1·40	15·0	14·8	good	fair
Juliana	— intensive	8·87	9·05	7·56	7·77	1·05	0·70	14·5	14·2	fair	r. poor
	normal	8·55	8·37	7·31	6·95	1·00	0·65	14·2	13·8	fair	r. poor
190/101	— intensive	9·46	9·38	8·46	8·14	1·60	1·30	15·0	15·0	poor	poor
	normal	9·21	9·19	8·06	7·68	1·70	1·10	15·0	15·2	r. poor	poor
Desprez 80	— intensive	8·99	9·12	7·70	7·61	1·50	0·90	14·3	13·0	v. good	f. good
	normal	9·03	8·62	7·56	6·97	1·35	0·85	13·5	12·8	f. good	f. good
S.H.M.	— intensive	10·16	9·59	8·64	7·77	1·00	0·75	14·0	14·2	poor	r. poor
	normal	9·44	8·88	8·01	7·15	1·00	0·70	14·3	13·8	poor	r. poor
Fen Trials.											
Yeoman II	... ...	11·9	12·23	10·16	10·61	1·7	1·05	15·1	15·2	v.g./exc.	fair
202/47B	... .	10·63	10·86	8·64	9·26	1·2	0·50	14·0	14·5	poor	r. poor
55/10/2C	... ...	9·17	9·16	7·84	8·0	2·2	1·05	15·1	14·0	poor	r. poor

1. Bread from flours of the Nos. 13, 15, 16 and 17 type.

2. Bread from flours of the 22, 23, 24 and 25 type.



TRIALS OF THE SPRING OATS

ONWARD, PARKER'S HUSKLESS, AND EARLY MILLER, BETWEEN THE YEARS 1935-1938.

E. G. THOMPSON, M.A.

The results of trials of Onward oat in 1935 have already been recorded in this Journal (Vol. IV, No. 2, 1937). Trials of this oat were continued in 1936 and 1937 at all Sub-stations of the Institute together with trials of Parker's Huskless oat. Early Miller was in trials at three centres in 1936, but in 1937 and 1938 the trials were confined to the Yorkshire centre. All the trials were conducted on the Beaven's half-drill strip system, except at Sprowston in 1937, where a " randomized block " layout was used. Victory was used as the control in all cases.

The varieties :—

Onward. A cross between Marvellous and Superb produced by Messrs. Gartons Ltd.

Parker's Huskless. A variety of Avena nuda closely similar to the Canadian oat Laurel. It was introduced to this country by W. Parker, of Babingley Hall, Kings Lynn.

Early Miller. A cross between Potato and Record, produced by the Scottish Society for Research in Plant Breeding.

The trials of Parker's Huskless oat were conducted as far as possible under the conditions recommended by the introducer, except at Cambridge in 1937, where two trials were grown, one under the recommended conditions and one under conditions chosen by the N.I.A.B. The conditions recommended in 1936 were April sowing and a seed rate of 45 lb. per acre. In 1937 earlier sowing was favoured, but the seed rate was maintained at 45 lb. per acre. Ten inch spacing between the rows was also recommended, but this width is difficult to fit in the ordinary Beaven's half-drill strip. In 1936 the ordinary strip of 4 rows, 6 inches apart, was used, but in 1937 this was altered to 3 rows, 9 inches apart, so as to conform as nearly as possible to the introducer's practice.

The particulars of the soils, previous cropping and manuring at the various centres are given in Table I. Seed of all varieties was dusted with a mercury compound dressing before sowing.

GENERAL CONDITIONS IN THE TRIALS.

1935.

The Onward trials were all sown between the 7th and 21st March and early growth was good. The season became hot and dry after the middle of

June, and at most centres crops suffered from drought. The ripening period was curtailed and there was no serious test of straw strength. At Askham Bryan weeds were troublesome in the early stages of growth and the crop was sprayed with sulphuric acid.

1936.

All the trials at Long Sutton were late sown, on the 9th April, but elsewhere the normal trials were sown in March. Askham Bryan drilled on the 24th March and the other four centres between the 16th and 18th March. The Huskless trials were sown between the 28th March and the 9th April, except at Sprowston, where sowing took place earlier, on the 19th March.

The season was a wet one, and while the growth was good in the east, at Sprowston and Cambridge, it was only moderate elsewhere and harvest was late. Frit-fly was very troublesome, particularly on the late sown Huskless trials, where the thin brairds of the Huskless oats suffered considerably. At Askham Bryan the crop was attacked by rust late in the season, and the late sown Huskless trial showed the greatest infection. At Long Sutton the under sown clover grew strongly and the straw was therefore cut high, leaving an 8 inch stubble. This had a slightly adverse effect on the recorded yield of straw of the shorter strawed varieties.

In spite of the wet season and low sunshine there was very little lodging, the only serious test of straw strength taking place at Newport.

1937.

The early spring of 1937 was abnormally wet so that drilling was impossible nearly everywhere until the end of March. At Sprowston drilling actually took place on the 23rd March, but Cambridge, Newport and Askham Bryan drilled on the 1st and 2nd April, while Cannington could not drill until the 23rd April and Long Sutton not until the 26th April. In spite of this abnormally late drilling frit-fly was only important at Cannington and Long Sutton, and the yields were higher than in the previous year at all centres except Cambridge and Cannington. Weeds were rather troublesome at Newport and Askham Bryan and both centres sprayed during May, Newport using a proprietary spray and Askham Bryan sulphuric acid.

The general conditions of growth during the season were fairly good, but, owing to the late sowing, harvesting was later than usual at most centres. There were no serious diseases except slight rust at Long Sutton, and no lodging except at Newport.

FIELD CHARACTERISTICS OF THE VARIETIES.

Tillering and early growth.

Victory and Onward were erect and did not tiller freely. Early Miller was not so constantly erect as Victory, and tillered a little more freely. It was difficult to compare Parker's Huskless oat with the others since it was sown at a lower seed rate. It was usually erect but tillered more freely than the control, mainly no doubt due to the thinner sowing.

Resistance to disease, etc.

There was evidence that both Onward and Huskless oats were slightly more susceptible to rust than Victory, but rust was common only at Canning-

ton in 1935 and Askham Bryan in 1936. Frit-fly was common, and the Huskless oats suffered rather more than the others, but again it must be emphasized that they were thinly sown and greater damage was therefore to be expected. On the other hand it was noted at one centre that frit-fly did more damage to the grain of Huskless than to that of Victory, its control.

Time of maturity.

Onward was, on the average, about two days earlier than Victory. Huskless was rather more variable in time of ripening, due to its thin sowing, but was usually one or two days earlier than Victory. No difference was observed between Early Miller and Victory in 1936, but at Askham Bryan in 1937 and 1938 Early Miller ripened about one day earlier than Victory.

Straw.

As far as length was concerned all the varieties were normally shorter than Victory, although the differences were by no means constant. Onward was, on the average, 2—3 inches shorter than Victory, while Huskless was 3—4 inches shorter than Victory. Early Miller was about 2 inches shorter than Victory in 1936, but at Askham Bryan in 1937 and 1938 it was equal to Victory.

Both Onward and Huskless had rather thicker straw than Victory.

The standing power of Early Miller straw was greater than that of Victory. Huskless also stood better than Victory, but again it must be remembered that the Huskless was sown much thinner, which helps standing. Onward was not materially different from Victory as regards standing power, but if the straw of Onward was allowed to become over-ripe it showed a tendency to break rather easily.

Grain. Feeding and market value.

The Institute is again indebted to Mr. C. J. Mapey for undertaking to value the grain from the trials. The actual values are set out in Table VII. The feeding value, judged by the percentage of husk, is set out in Table VI. No figures are available for the market value of Huskless oats since these are unknown in general commerce.

CONSIDERATION OF THE VARIETIES.

Onward is a very heavy yielding oat which ripens early and stands as well as Victory. The grain is husky but is short and is valued at least as highly as Victory. The yield of kernel is greater than that of Victory, but judging from trials of Victory against Eagle, it is rather lower than that of Eagle; the yield of straw is also less and it is slightly more susceptible to rust. It cannot therefore be recommended before Eagle for home feeding, but for growers who intend to sell their oats this is one of the most profitable varieties they can grow.

Parker's Huskless. The trials of this oat were arranged in order to test claims which were being put forward as to its field behaviour. In the opinion of the Institute the seed rate recommended was much too low for ordinary conditions and the crops suffered from weed competition and frit-fly damage. The yield figures have, therefore, no value as a measure of the

real cropping powers of the oat, and it has not been considered worth while adjusting these figures to allow for the husk of the control. On the other hand, at Cambridge in 1936, the weeds were kept under control by hand hoeing, and in one trial in 1937 the seed rate was increased to correspond to that of Victory. On the first of these occasions the yield was not significantly different from that of Victory when husk was allowed for, while on the second occasion it was definitely below that of Victory.

There are no indications, therefore, that the oat has any outstanding merits in the field, and in the absence of any special value attached to the "huskless" condition, it cannot be recommended for general cultivation.

Early Miller. This variety has the Potato oat as one parent, and like that oat, is not suited to the southern half of England. At Askham Bryan, in Yorkshire, the yield of grain over a period of three years was not significantly different from Victory. The straw stood well and the grain was valued rather more highly than that of Victory. If considered purely from the point of view of the sale of grain, however, Early Miller was inferior to Onward even at this centre, although the yield of straw was higher and the grain was of better feeding quality.

Table I.

SPRING OAT TRIALS, 1935-37.

Summary of soils with height above sea level, manuring and previous cropping. Weights all in cwts. per acre unless otherwise stated.

Season	Cambridge	Cannington	Long Sutton	Newport	Sprowston	Askham Bryan
1935	Heavy clay. 80 ft. 3 Super. 1 30% Potash Salts. 1½ Nitro-Chalk. Wheat.	Silty loam. 40-70 ft. No manure. Sugar Beet.	Heavy stony loam 480 ft. 1½ Super. 1½ 30% Potash Salts. 1 Sulphate of Ammonia. Clover.	Sandy loam. 220 ft. Aftermath grazed by sheep and ploughed in. Seeds.	Free working loam 100 ft. 3 Super. 1 Muriate of Potash. 1 Sulphate of Ammonia. Wheat.	Sandy loam. 72 ft. 2 Super. 1½ 30% Potash Salts. 1 steamed bone flour. 1 Sulphate of Ammonia. Wheat.
1936	Heavy clay. 80 ft. 2 Super. 1 30% Potash Salts. 1 Nitro-Chalk. Mangolds.	Silty loam. 65-70 ft. No manure. Roots.	Medium-heavy stony loam. 420 ft. 10 tons farmyard manure. 1½ Super. 1 30% Potash Salts. ½ Sulphate of Ammonia. Spring Oats.	Loamy sand. 215-225 ft. 1 Nitrate of Soda. Sugar Beet.	Free working loam. 93 ft. 2 Super. 1 Potash Salts. 1 Sulphate of Ammonia. Barley.	Light sandy loam 72 ft. No manure. Seeds.
1937	Heavy clay. 80 ft. 1 Nitro-Chalk. Mangolds.	Silty loam. 50 ft. 3 Super. 1 Sulphate of Ammonia. Sugar Beet.	Medium-heavy stony loam. 485 ft. 1 Super. 1 30% Potash Salts. 1 Sulphate of Ammonia. Wheat.	Loamy sand. 215 ft. Tops "sheeped". Sugar Beet.	Free working loam. 93 ft. 1¼ Super. 1¼ 30% Potash Salts. 2½ Sulphate of Ammonia. Barley and Oats.	Light loam. 90 ft. No manure. Seeds.

Table II.

YIELD OF ONWARD IN TRIALS IN 1935.

Significant yield differences are printed in heavier type.

Station and yield per acre of control variety, threshed weight	Yield of grain as percentage of control, dry weight	Difference from control	Standard error of difference	Yield of straw as percentage of control
CAMBRIDGE. Victory, 23·7 cwt.	119	**+ 19**	2·04	93
CANNINGTON. Victory, 21·4 cwt.	110	**+ 10**	1·71	81
LONG SUTTON. Victory, 19·5 cwt.	103	**+ 3**	1·30	87
NEWPORT. Victory, 24·2 cwt.	103	**+ 3**	1·18	87
SPROWSTON. Victory, 24·6 cwt.	110	**+ 10**	2·22	81
ASKHAM BRYAN. Victory, 26·4 cwt.	107	**+ 7**	1·68	77

Table III.

YIELD OF SPRING OATS IN TRIALS IN 1936.

Significant yield differences are printed in heavier type.

Station and yield per acre of control variety, threshed weight	Name of variety	Yield of grain as percentage of control, dry weight	Difference from control	Standard error of difference	Yield of straw as percentage of control weight
CAMBRIDGE.					
Victory	Onward	118	**+18**	2·12	96
Average yield per	Huskless	74	**−26**	1·19	94
acre, 25.3 cwt.	Pure Line Potato	84	**−16**	2·30	105
CANNINGTON.	Onward	102	+ 2	1·49	77
Victory	Early Miller	86	**−14**	0·69	91
Average yield per	30/2	108	**+ 8**	1·04	81
acre, 17·9 cwt.	Huskless	36	**−64**	2·86	58
LONG SUTTON.					
Victory	Onward	111	**+11**	1·93	81
Average yield per	Huskless	43	**−57**	2·99	48
acre, 13·4 cwt.					
NEWPORT.	Onward	110	+10	4·79	93
Victory	Huskless	37	**−63**	3·28	63
Average yield per	Pure Line Potato	87	**−13**	3·65	106
acre, 22·3 cwt.	Early Miller	91	**− 9**	3·57	93
SPROWSTON.	Onward	123	**+23**	2·31	
Victory	Huskless	50	**−50**	1·79	79
Average yield per					83
acre, 20·6 cwt.					
ASKHAM BRYAN.	Onward	118	**+18**	1·96	80
Victory	Early Miller	101	+ 1	2·46	87
Average yield per	Huskless	62	**−38**	1·76	83
acre, 19·5 cwt.					

Table IV.

YIELD OF SPRING OATS IN TRIALS IN 1937.

Significant yield differences are printed in heavier type.

Station and yield per acre of control variety, threshed weight	Name of variety	Yield of grain as percentage of control, dry weight	Difference from control	Standard error of difference	Yield of straw as percentage of control weight
CAMBRIDGE. Victory Average yield per acre, 20·0 cwt.	Onward	113	**+13**	1·92	68
	Huskless @ 45 lb.	50	**−50**	3·27	75
	Huskless @ 90 lb.	63	**−37**	2·04	87
CANNINGTON. Victory Average yield per acre, 14·2 cwt.	Onward	82	**−18**	2·20	61
	Huskless	17	**−83**	2·48	38
LONG SUTTON. Victory Average yield per acre, 18·4 cwt.	Onward	107	+ 7	4·46	86
	Huskless	43	**−57**	4·07	64
NEWPORT. Victory Average yield per acre, 26·1 cwt.	Onward	98	− 2	4·48	77
	Huskless	44	**−56**	3·74	68
SPROWSTON. Victory Average yield per acre, 25·7 cwt.	Onward	105	**+ 5**	1·44*	76
	Huskless	42	**−58**		58
ASKHAM BRYAN. Victory Average yield per acre, 25·0 cwt.	Onward	116	**+16**	2·97	82
	Huskless	28	**−72**	2·98	54
	Early Miller	103	+ 3	2·97	98
	1938.				
ASKHAM BRYAN. Victory, 42·6 cwt.	Early Miller	95	− 5	1·71	95

* S.E. of randomised trial.

Table V.

AVERAGE YIELD OF ONWARD AND HUSKLESS OATS, 1935-37, AND EARLY MILLER, 1936-38.

The figures in brackets indicate the number of trial results included in the average.

	Cambridge	Cannington	Long Sutton	Newport	Sprowston	Askham Bryan	General average
			GRAIN.				
Victory (control)	100·0	100·0	100·0	100·0	100·0	100·0	100·0
Onward	116·7 (3)	98·0 (3)	107·0 (3)	103·7 (3)	112·7 (3)	113·7 (3)	108·6 (18)
*Huskless	62·3 (3)	26·5 (2)	43·0 (2)	40·5 (2)	46·0 (2)	45·0 (2)	45·3 (13)
Early Miller ...	—	86·0 (1)	—	91·0 (1)	—	99·7 (3)	95·2 (5)
* See note on p. 391.							
			STRAW.				
Victory (control) ..	100·0	100·0	100·0	100·0	100·0	100·0	100·0
Onward	85·7 (3)	73·0 (3)	84·3 (3)	85·7 (3)	78·7 (3)	79·7 (3)	81·2 (18)
Huskless	85·3 (3)	48·0 (2)	56·0 (2)	65·5 (2)	70·5 (2)	68·5 (2)	67·1 (13)
Early Miller ...	—	91·0 (1)	—	93·0 (1)	—	93·3 (3)	92·8 (5)

Table VI.

HUSK AS A PERCENTAGE OF TOTAL GRAIN WEIGHT.

Each figure is the average husk of five samples each of 100 grains.

		Onward	Victory Control to Onward	Early Miller	Victory Control to Early Miller
1935.	Cambridge ...	34·3	29·0		
	Cannington ...	31·8	28·5		
	Long Sutton ...	32·0	27·3		
	Newport ...	31·3	26·8		
	Sprowston ...	30·0	27·2		
	Askham Bryan .	30·8	26·8		
1936.	Cambridge ...	30·0	26·4		
	Cannington ...	31·9	27·4	27·7	27·2
	Long Sutton ...	32·6	29·9		
	Newport ...	31·0	25·3	26·0	26·2
	Sprowston ...	30·1	28·7		
	Askham Bryan .	31·0	26·6	26·2	25·8
1937.	Cambridge ...	29·4	27·1		
	Cannington ...	33·2	27·7		
	Long Sutton . .	31·6	28·1		
	Newport ..	30·6	26·1		
	Sprowston ...	29·5	25·2		
	Askham Bryan .	31·4	27·3	26·8	26·7
1938.	Askham Bryan .	—	—	25·4	23·7
Average		31·3	27·3	26·4	25·9
Equal to kernel ...		68·7	72·7	73·6	74·1
Kernel, when control = 100		94·5	100·0	99·3	100·0

Table VII.

Valuation of the grain in shillings per 336 lb.

		Onward	Victory Control to Onward	Early Miller	Victory Control to Early Miller
1935.	Cambridge ...	21·0	20·0		
	Cannington ...	21·5	20·0		
	Long Sutton ...	21·0	20·0		
	Newport ...	21·0	21·5		
	Sprowston ...	22·0	21·0		
	Askham Bryan .	20·5	19·0		
1936.	Cambridge ...	24·0	24·0		
	Cannington ...	24·0	25·0	25·0	24·0
	Long Sutton ...	24·0	23·5		
	Newport . .	22·5	23·0	23·0	23·0
	Sprowston ...	23·0	22·0		
	Askham Bryan .	23·0	23·0	24·5	24·0
1937.	Cambridge ...	28·5	28·5		
	Cannington ...	27·0	27·5		
	Long Sutton ...	28·5	28·0		
	Newport ...	28·5	28·5		
	Sprowston . .	28·0	28·5		
	Askham Bryan .	28·5	28·0	28·0	27·5
1938.	Askham Bryan .	—	—	19·5	18·5
Average in shillings ...		24·3	23·9	24·0	23·4
As percentage of control		101·3	100·0	102·6	100·0

THE LORD DERBY GOLD MEDAL TRIALS, 1938

H. BRYAN, B.Sc.

The under-mentioned five varieties were included in these trials in 1938 :—

1st YEAR ENTRIES :

Ulster Chieftain (J. Clarke) — first-early.
Seedling 233/13 (D. MacKelvie) — second-early.
Seedling 222/8 (D. MacKelvie) — early maincrop.

2nd YEAR ENTRY :

Dunbar Archer (C. T. Spence) — late maincrop.

3rd YEAR ENTRY :

Ulster Monarch (J. Clarke) — second-early.

1st YEAR ENTRIES.

No award was made in the case of the first-year entries but the raisers were given the option of sending in their varieties for a second year's extended test, free of charge, and each has accepted.

2nd YEAR ENTRY.

Dunbar Archer (C. T. Spence).

This variety was tested in the Gold Medal trials in 1937, no award was made, but the introducer was given the option of re-entering it the present year, free of charge. The controls used were Dunbar Standard, a variety of similar maturity awarded a Gold Medal in 1936, and Majestic.

Seedling 1327 (McGill & Smith) was included in the trial for the purpose of obtaining information as to the susceptibility of the tubers to blight and the health of the stock. *Dunbar Rover*, a new second-early variety, was also included for observation purposes.

The trial at Ormskirk was laid out on the usual lines and was planted in good order on the 8th April with eight randomized drill plots of each variety and seventy cut setts per drill. The weight of the tubers of Dunbar Rover and Dunbar Archer was approximately 3½ oz. each, and those of Majestic and Dunbar Standard 2½ oz. All seed was received during the early part of March and immediately boxed. The average length of the sprouts at planting time was 1½″, with the exception of those of Dunbar Standard, which averaged ¾″. As in all yield trials there was a surround variety which was discarded on lifting.

Owing to weather conditions growth was much retarded at the beginning of the growing season but was normal by mid-July, and by the end of the month was strong and vigorous. It was evident by the end of June that seedling 1327 showed a high percentage of virus infection, the symptoms being a mild mottle which imparted an unhealthy yellow colour to the infected plants, no distortion of the leaflets or reduction in the size of the plants occurred.

The seed of the Dunbar series was supplied from the introducer's special stocks and as was to be expected no virus symptoms were observed. Similarly the Majestic grown from Aberdeenshire stock seed showed no virus symptoms.

The number of misses, except in the case of Majestic was negligible and was as follows:—Majestic, 15; seedling 1327, 4; Dunbar Rover, 5; Dunbar Archer, 2; and Dunbar Standard, 7.

A slight attack of blight was noticed towards the end of July, which spread slowly and apparently uniformly. As has been invariably noticed at Ormskirk there was a marked correlation between the incidence of blight on the foliage and the maturity of the variety.

Maturity.

Dunbar Rover and seedling 1327 (its maturity hastened by virus infection) showed the highest proportion of blight which towards the end of August was prevalent on both. Dunbar Rover was mature by the 5th September, and Majestic and seedling 1327 by the 12th September, Dunbar Archer and Dunbar Standard showed the same amount of blight infection on the foliage and were considered mature by the 26th September.

Yield.

All stocks were carefully lifted by hand when mature and graded over 1⅝″ riddle. The number of tubers infected with blight was negligible and was not recorded. There were no significant differences between the yields of ware of Dunbar Archer, Dunbar Standard and Majestic.

SUMMARY OF RESULTS (ware dressed 1⅝″).

	Yield of ware (tons per acre).	Percentage of ware.
Dunbar Archer ...	12·1	93
Dunbar Rover ...	10·0	93
Dunbar Standard ...	11·8	91
Majestic ...	12·1	93

Standard Error (ware) = 0·36. Significant difference 1·17 tons.

Check Trial at Kirton.

A trial, on similar lines and layout, was carried out by the Agricultural Institute at Kirton.

Planting was done on March 22nd and the crop was lifted on October 28th.

The following yields were obtained :

	Yield of ware (tons per acre).	Percentage ware.	Percentage of blighted tubers.
Dunbar Archer ...	9·09	95	12·1
Dunbar Rover ...	7·24	94	7·2
Dunbar Standard ...	11·29	95	6·8
Majestic	11·37	96	4·9

Standard Error (ware) = 0·43. Significant difference 1·41 tons.

The crop was graded over a $1\frac{5}{8}''$ riddle.

General.

As in previous years at Ormskirk the tubers of Dunbar Archer were of a poor nondescript shape. The produce of Dunbar Standard on the other hand was very attractive and members of the Committee who grew this variety on the commercial scale in 1938 confirm the view that the Gold Medal award was fully justified.

The Committee was unanimously of the opinion that in view of its similarity of foliage and maturity to Dunbar Standard and the unsatisfactory shape of the tubers that no award should be made.

DESCRIPTION OF DUNBAR ARCHER.

Sprout : Blue.

Tuber : Short oval; flesh white; skin white; eyes shallow to medium.

Haulm and Foliage : Tall, upright; leaf rigid; leaf and leaflet stalks tinged pink; leaflets medium green and pointed; secondary leaflets numerous; wings very wavy; stems very strong, branching freely, mottled.

Flowers : White, fairly profuse; anthers orange; buds pink.

3rd Year Entry.

Ulster Monarch (J. Clarke).

In 1936 the decision on a Gold Medal award was withheld owing to the presence of spraing in the clamped produce. It was decided that the variety should be grown in six different centres in England the following year and the produce from each centre examined for the presence of spraing. If the defect was found to be " substantially present " no award would be made, if the defect was " substantially absent " the award would follow automatically. As a result of the examination it was decided that spraing was substantially present. A further test, however, was decided on in 1938, when Ulster Monarch with a number of control varieties was grown at four centres in England where spraing is known to occur. As a result of these trials it was again found that spraing was substantially present in the variety. In addition, owing to a marked tendency to grow too near the surface of the soil, considerable greening of the tubers—which were consistently irregular in shape—occurred.

The Committee decided that no award could be made to this variety.

REPORT OF THE POTATO SYNONYM COMMITTEE

ON THE POTATOES SENT FOR IMMUNITY TRIALS TO THE POTATO TESTING STATION, ORMSKIRK, LANCS., 1938.

The following served on the Committee :—

F. J. Chittenden, F.L.S., V.M.H.
W. D. Davidson, Ph.D.
A. A. McAlister
T. P. McIntosh, Ph.D.
R. B. Strang, N.D.A.,
B. C. C. Waight,

and

Redcliffe N. Salaman, M.D., J.P., F.R.S. (Chairman).

The trials this year took place under weather conditions of an unusual kind. The spring months were unusually dry and warm so that early-sown seed had little chance of " getting away ". May was very unsettled and the summer months of June and July cold, dull and exceptionally wet, and although towards the end of the month and in the early part of August growing conditions improved, stocks remained backward. In the latter part of August the weather was close and damp, and blight attacked the haulms; the tubers, however, were in general unaffected.

From another point of view the season was highly propitious—it was an ideal year for the development of Wart Disease. It may here be mentioned that this gave Mr. Bryan and Mrs. McDermott an opportunity for making a comparison between glasshouse and field trial results under the most favourable conditions. They found that no seedling which had passed the glasshouse test as resistant showed any trace of disease in the field; even a seedling which in the glasshouse had shown incipient wart with winter sporangia, developed no sign of wart when grown in the most highly infected portion of the farm.

A unique feature of this year's trial is the elimination of the group " Distinct varieties Susceptible to Wart ". The disappearance of this group is eloquent testimony to the intelligence of the breeder, the adequacy of the departmental official machinery to discover susceptibility and, last but not least, to the persistence and skill of mycologists and geneticists alike who have devoted so much patient work to the improvement of our potato stocks.

The number of plots examined was 66 of which one was too poor and one too mixed for judging, leaving 64 : of these, three stocks were synonymous with existing varieties and one with a seedling which the sender had entered in a previous season : this latter case was purely accidental and calls for no comment. The other remaining synonymous stocks show little ingenuity on the part of their sponsors : all three employ prototypes which have performed a similar service scores of times during the last twenty years.

Four synonymous stocks, still offered for sale in the catalogues of well-known seedsmen, all of which had been grown in previous years at Ormskirk, were again grown alongside the corresponding correctly-named varieties and were found to be at least constant to their false colours—a feature which has not been so general as might be expected.

Although the larger seedsmen have, with but one or two exceptions, loyally adhered to the principle of correctly describing the potato stocks offered for sale, there is still much to be done up and down the country in order to eliminate synonyms from catalogues and sale announcements of local seedsmen. It is the smallholder and private grower for the most part who purchase their seed locally, and it is they who stand most in need of protection. By means of publicity in the press and the circulation of pamphlets we cannot hope that much more can be done, and it is by appropriate legislation alone that this evil can be finally stamped out.

The following group of entries have been examined :—

Stocks indistinguishable from established varieties ...	3
Stock synonymous with seedling previously tested ...	1
Stock too poor to be judged	1
Stock too mixed to be judged	1
Interdepartmental check varieties distinct and free from Wart Disease	12
Distinct varieties free from Wart Disease	48
	66

(Signed on behalf of the Committee),

REDCLIFFE N. SALAMAN, F.R.S.,
Chairman.

STOCKS INDISTINGUISHABLE FROM ESTABLISHED VARIETIES.

Plot No.	Variety.	Sender.	Incidence of Wart Disease in the Field.
		ARRAN COMRADE.	
94	Unnamed	W. H. Drummond, Knebworth, Herts.	No wart seen.
		GREAT SCOT.	
92	White Emperor	G. A. Stuart, Aberdeen	,, ,, ,,
		KERR'S PINK.	
102	No. 13	J. Bailiff, Frizington, Cumberland.	,, ,, ,,

STOCK SYNONYMOUS WITH SEEDLING PREVIOUSLY TESTED.

83	23416	McGill & Smith, Ltd., Ayr.	No wart seen.

STOCK TOO POOR TO BE JUDGED.

56	Ellington's Coronation	J. Ellington, Bury St. Edmunds.	No wart seen.

STOCK TOO MIXED TO BE JUDGED.

48	No. 2	Dr. Redcliffe N. Salaman, Barley, Herts.	No wart seen.

INTERDEPARTMENTAL CHECK VARIETIES.

DISTINCT VARIETIES FREE FROM WART DISEASE IN THE FIELD.

107	592 (Clarke)	Ministry of Agriculture for Northern Ireland
108	603 (Clarke)	ditto
109	616 (Clarke)	ditto
110	D.C.M.1066 (Rae)	Department of Agriculture for Scotland.
111	C.65 (Harper)	ditto
112	O.R.A.21	ditto
113	O.R.A.37	ditto
114	O.R.A.42	ditto
115	L.55 (Spence)	ditto
116	322 (80) S.S.R.P.B.	ditto
117	398a (41) S.S.R.P.B.	ditto
118	451a (20) S.S.R.P.B.	ditto

DISTINCT VARIETIES FREE FROM WART DISEASE IN THE FIELD.

Plot No.	Variety.	Sender.
SECOND YEAR STOCKS :		
2	222/5	D. MacKelvie, Lamlash.
4	222/21	ditto
7	232/30	ditto
9	233/12	ditto
11	233/63	ditto
14	5184	Sutton & Sons, Ltd., Reading.
16	5188	ditto
18	5189	ditto
21	1	J. Bailiff, Frizington, Cumberland.
23	4	ditto
26	6	ditto
28	8	ditto
30	10	ditto
33	26/34	Wm. B. Pollock, Bishopton, Renfrewshire.
35	84/34	ditto
38	94/34	ditto
41	101/34	ditto
43	117/35	ditto
46	E.162	C. T. Spence, Dunbar.
51	318 (38)	Scottish Society for Research in Plant Breeding, Edinburgh.
53	Miss Vince	R. Carrington Willis, High Wycombe.
55	Mixed Grill	ditto
FIRST YEAR STOCKS :		
59	222/6	D. MacKelvie, Lamlash.
60	233/18	ditto
61	247/1	ditto
63	247/7	ditto
64	247/18	ditto
65	247/28	ditto
67	250/5	ditto
68	250/12	ditto
69	255/19	ditto
70	259/4	ditto
72	5145	Sutton & Sons, Ltd., Reading.
73	5150	ditto
75	5155	ditto
76	5223	ditto
77	5229	ditto
79	1343	McGill & Smith, Ltd., Ayr.
80	7345	ditto
82	7348	ditto
84	23417	ditto
85	73413	ditto
87	73417	ditto
88	153/35	Wm. B. Pollock, Bishopton, Renfrewshire.
89	384a (14)	Scottish Society for Research in Plant Breeding, Edinburgh.
90	387b (56)	ditto
99	Floury Spring	R. Carrington Willis, High Wycombe.
101	E.65	C. T. Spence, Dunbar.

REPORT ON PURCHASED STOCKS OF SYNONYMS, 1938.

Name under which stock was purchased.	Vendor.	Result of examination in 1938. Synonymous with	When previously tested found to be synonymous with
Cherub	D. & W. Croll, Ltd., Dundee.	Duke of York	Duke of York
Earliest of All	J. E. Knight & Son, Wolverhampton.	Sharpe's Express	Sharpe's Express
Dreadnought	ditto	Great Scot (with 3 Doon Star rogues)	Great Scot
Lord Allendale	Wm. Fell & Co. (Hexham) Ltd.	Red King Edward VII	Red King Edward VII

THE OFFICIAL SEED TESTING STATION

FOR

ENGLAND AND WALES.

TWENTY-FIRST ANNUAL REPORT

Covering the period 1st AUGUST, 1937—31st JULY, 1938.

A. EASTHAM, D.S.O., M.C., B.Sc., and C. C. BRETT, M.A.

During the period covered by the following report, the number of samples received by the Station for analysis reached 36,840. This figure is higher than that of any preceding season and is 2,951 more than in the immediately preceding season—itself a record year—and represents an increase of approximately 8·7%. The average number of samples per season for the previous nineteen seasons affords an interesting comparison. This average figure is 25,344 and it will be seen that the number of samples received during the season 1937-38 exceeds this average by nearly 11,500 samples, an increase of 45·4% and providing a striking illustration of the progressive increase in the volume of the work performed by the Station. It is of interest to note that by the end of the season under review, a total of over half a million samples had been tested by the Station since its inception. As in previous seasons, it was necessary throughout the year, to conduct a number of tests of an investigational character. These were undertaken in connection with problems which arose out of the season's experiences and in furthering investigations which were already in progress and amounted to 2,055, thus bringing the total of samples tested during the twelve months ending the 31st July, 1938 to 38,895.

SOURCES OF SAMPLES RECEIVED.

Table I shows the various sources from which the samples tested were received and the number of samples from each source. The number of samples received from farmers includes only those tested for farmers and growers at the special reduced fee, i.e. where the results of the tests were for the sender's own seeding purposes and were not to be used as a basis of declaration for sale. Where the samples submitted by farmers were for sale purposes—to enable the senders to comply with the provisions of the Seeds Act 1920—the full fees were charged and the number of such samples has been included in the figures representing the number of samples from seed firms. Samples from public departments include the samples taken by Inspectors of the Ministry of Agriculture in connection with the administration of the Seeds Act.

There is a slight decrease, compared with the previous season, both in the number of seed firms and in the number of farmers submitting samples to be tested. However, the number of farmers utilizing the Station's services remains at a satisfactorily high level, compared with less recent seasons. Although the number of seed firms has fallen slightly, the number of samples from this source has increased, bringing the average number of samples received per firm up to 19·9 samples, as compared with 17·4 samples in the previous year.

Table 1. *Shows sources of samples received.*

	1937-38	1936-37	1935-36
Seed Firms. Number sending samples	**1512**	1547	1519
,, ,, ,, of samples received	**30171**	26878	23397
Farmers, etc. ,, sending samples	**1092**	1173	877
,, ,, ,, of samples received	**2360**	3027	2410
Public Depts. ,, of samples received	**4309**	3984	4063
Total number of samples	**36840**	33889	29870

DISTRIBUTION OF SAMPLES ACCORDING TO SPECIES.

The number of samples of each kind of seed received during the season is shown in Table II, together with the total of samples in each group and corresponding figures for the two previous seasons.

The total increase in numbers over the season 1936-37 (2,951 samples) is accounted for by a general increase throughout the groups. In each group the total exceeds that of the preceding year, the greatest numerical and relative increases occurring in the root and vegetable seed group and the clover group. In the case of the cereal, clover and grass groups, the totals recorded are higher than in any previous season. The total shown by the pulse group has only once been exceeded and that of the root and vegetable seed group has been exceeded on only two previous occasions.

The increase in the total of the cereal group is chiefly due to the greater number of wheat samples received; the increase in barley samples is offset by the fall in oat samples. In the case of both wheat and barley, the figures are the highest yet recorded for these species. Within the pulse group there is an increase under each heading and the figures for both peas and beans are amongst the highest yet recorded.

There are only two cases amongst the species listed in the root and vegetable seed group, where the number of samples is less than in the previous year. All the other species show increases of varying magnitude, the greatest numerical increases being in the case of mangold and of beet. The figures for kale, brussels sprouts and beet are the highest yet recorded for these species and those for cabbage, broccoli and cauliflower and mangold have only once been higher in each case.

Increases over the previous season's figures are shown in all the species within the clover group, with the exception of lucerne and of crimson clover. The greatest numerical increases are shown by red clover, white clover and trefoil. In the case of both the former and the latter, the figures shown are higher than in any previous season. The number of white clover samples

Table II. *Shows number of samples of different kinds of seeds tested.*

	1937-38	1936-37	1935-36
Cereals			
Wheat	**8101**	7499	5991
Barley	**2855**	2562	1705
Oats	**5410**	5743	4270
Rye	**162**	135	176
Maize	**78**	62	47
	16606	16001	12189
Pulses			
Peas	**1908**	1772	1895
Beans	**565**	483	503
Vetches	**375**	364	343
	2848	2619	2741
Roots and Vegetables			
Turnip	**469**	427	475
Swede	**571**	526	598
Rape	**84**	78	74
Kale	**482**	383	405
Cabbage	**585**	569	556
Brussels Sprouts	**176**	124	127
Broccoli and Cauliflower ...	**407**	335	374
Other Crucifers	**131**	128	146
Mangold	**1070**	782	804
Beet	**1161**	1019	789
Onion	**533**	441	495
Parsnip	**131**	113	132
Carrot	**276**	310	351
Other Vegetables	**176**	234	219
	6252	5469	5545
Clovers			
Red Clover	**3451**	3062	2930
Alsike	**277**	205	213
White Clover	**1245**	1101	1172
Trefoil	**659**	543	474
Lucerne	**73**	99	114
Sainfoin	**321**	276	240
Crimson Clover	**91**	110	173
Other Legumes	**69**	56	44
	6186	5452	5360
Grasses			
Perennial Ryegrass	**1216**	1035	1002
Italian Ryegrass	**522**	538	443
Cocksfoot	**315**	299	286
Timothy	**229**	202	198
Meadow Fescue	**87**	85	81
Crested Dogstail	**269**	277	214
Other Grasses	**1409**	1205	1051
Mixtures	**387**	352	386
	4434	3993	3661
Linseed	**180**	52	63
Forest Trees	**83**	106	104
Miscellaneous	**251**	197	207

has only once been exceeded, whilst lucerne samples are fewer than in any preceding year.

The species within the grass group all show increases over the previous year, except in the case of Italian ryegrass and of crested dogstail; in the latter case, however, the figure is still amongst the highest recorded. The figures for perennial ryegrass and for " other grasses " are higher than in any previous season and the total of mixtures has only once been exceeded.

As an indication of the general increase in samples throughout the season under review, it should be pointed out that of the forty-one species or species groups shown in Table II, figures higher than those of the previous season are shown in thirty-three cases.

SAMPLES RECEIVED EACH MONTH.

The distribution of samples per month during the season is shown in Table III, together with comparable figures for the previous season. A curve plotted from this season's figures follows, in general trend, that of the average of all previous seasons, except that the peak periods of September-October and February-March are much more pronounced in the season under review. In the season 1937-38 the number of samples received per month exceeds the average of all previous seasons by over 2,000 in both September and February, by nearly 2,000 in October, by over 1700 in December and by 1400 in March. The figures recorded in the table for August, September, December, January, February and March are higher, for these months, than in any previous season. The average number of samples received per working day is 176 for September and October and 243 for February and March, whilst the average number per working day over the whole year is 120.

Table III. *Shows number of samples received per month.*

Season.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
1937-38 ..	**1434**	**4103**	**5077**	**2411**	**3559**	**3976**
1936-37 .	885	3331	5544	2722	2280	3009
Season.	Feb.	Mar.	April	May	June	July
1937-38 ...	**6337**	**6062**	**2064**	**1169**	**338**	**310**
1936 37 ..	5011	5337	3580	1004	519	667

PURITY AND GERMINATION.

Figures indicating the average quality of the various species tested throughout the season are given in Tables IV, V, VI and VII. For each of the species in the tables, figures are given representing the average germination for the season under review, and in Tables VI and VII the average purity figures are also shown. To allow of comparison, figures representing the total average of all previous seasons are recorded, and as a further indication of average quality, the percentage number of samples germinating below the minimum percentage of germination laid down in the Seeds Regulations 1922 is given for those species for which such a standard has been prescribed. In the case of both grasses and clovers, the tables also include figures showing the percentage of samples found to contain one per cent. or more of " injurious weed seeds ".

Certain species included amongst the root and vegetable seeds are known to lose vitality somewhat rapidly and in most seasons the Station receives samples of such seeds from stocks which have been carried over from the previous season. Such samples are not infrequently of relatively low germination and in the majority of cases the bulks they present would not be distributed. Consequently, in certain instances, the figures shown in Table V do not necessarily reflect with accuracy the quality of the majority of bulks passing through the usual trade channels throughout the country.

Although the average germination of barley, oats and rye, for the season under review, is rather higher than in the previous season, yet the figures in each case still fall somewhat below the average of all previous seasons.

In the majority of cases, the figures for average germination recorded in the pulse and root and vegetable seed group, are somewhat above average. Field beans show a marked improvement, the average figure for the season being the highest yet recorded. Dwarf beans are well above average, but for runner beans the average germination is the lowest since 1928-29. In the case of kale, cabbage, brussels sprouts and kohl rabi, the average germination figures are well above the average of all previous seasons and in the case of the two former species, the figures recorded have only once been higher. Turnip shows a marked deterioration, the figure recorded being lower than in any previous season. Mangold is again well above the average, whilst garden beet, sugar beet and parsnip are all lower than in the two preceding seasons.

With respect to purity, the grasses generally are somewhat above the average, but the germination figures show little relative change. The average purity of meadow fescue is higher than in any previous season and in the case of both timothy and crested dogstail the figures are the highest for at least ten years. Italian ryegrass is of an average purity which has only once been lower and that of cocksfoot is lower than in the three previous years. The average germination of both perennial and Italian ryegrass is lower than in the three previous years, but that of cocksfoot is the highest for six seasons. Amongst the species not scheduled in the Seeds Regulations 1922, Poa nemoralis shows an average purity higher than in any year since 1929-30. The germination of meadow foxtail is lower than in any year since 1924-25 and that of Chewing's fescue the lowest since 1932-33.

A general improvement in average purity is shown throughout the clover group, when compared with the averages of all previous seasons. The figures for English red clover and for wild white clover are the highest yet recorded, whilst those for red clover (all samples) and crimson clover are higher than for several years. Figures somewhat lower than those of immediately preceding years are recorded in the case of both alsike and trefoil. The average germination of English red clover is higher than in the previous year and that of Chilean red clover, although below average, is somewhat higher than in the previous four years. The figure shown for Mid-European white clover is lower than for many years and that for lucerne is lower than any previously recorded. In general, the average percentage of hard seeds throughout the group, remains at a relatively high level.

Table IV. *Shows percentage germination of cereals.*

	Number of samples included in the averages	Average percentage of germination		Percentage of samples below authorised minimum.	
		1937-38	1917-37	**1937-38**	1936-37
Wheat	7295	**96·7**	96·1	**4·3**	7·4
Barley	2624	**94·1**	95·1	**12·8**	11·4
Oats	5109	**92·7**	93·3	**7·1**	9·5
Rye	147	**87·9**	90·2	**15·0**	16·0

Table V. *Shows percentage germination of pulses and root and vegetable seeds.*

	Number of samples included in the averages	Average percentage of germination		Percentage of samples germinating below authorised minimum (authorised minimum in brackets)
		1937-38	1917-37	
Peas (Field and Garden) .	1669	**88·2**	88·6	11.3 (80 F., 70 G.)
Beans (Field)	235	**98·2**	95·6	1·7 (90)
Beans (Broad)	92	**94·7**	94·0	2·2 (75)
Beans (Runner)	111	**81·7**	81·5	10·8 (60)
Beans (Dwarf)	50	**89·3**	84·6	8·0 (75)
Vetches	355	**88·1**	89·9	24·2 (90)
Turnip (Field and Garden) .	370	**77·9**	85·5	25·4 (80 F., 75 G)
Swede	445	**84·0**	83·9	17·9 (80)
Rape	79	**88·8**	88·6	14·0 (80)
Kale	427	**85·3**	80·3	8·7 (70)
Cabbage	455	**83·8**	79·6	13·8 (70)
Brussels Sprouts	145	**85·2**	80·6	6·6 (70)
Broccoli and Cauliflower ...	353	**73·7**	76·9	18·4 (60)
Kohl Rabi	24	**81·9**	75·3	8·3 (70)
Mangold	942	**79.2**	76·9	6·6 (60)
Beet (Garden)	243	**66·8**	71·4	15·6 (50)
Beet (Sugar)	771	**84·8**	83·4	18·2 (60)
Parsnip	54	**70·4**	65·8	15·7 (45)
Carrot	151	**68·0**	65·4	5·9 (50)
Onion	385	**62·8**	70·7	37·1 (60)
Other seeds.		**1937-38**	1936-37	
Mustard	53	**86·0**	82·1	
Lettuce	41	**81·9**	76·3	
Radish	36	**84·2**	80·6	
Celery	60	**70·6**	75·9	
Parsley	20	**73·9**	73·6	
Spinach	14	**62·1**	73·8	
Flax	166	**90·2**	92·7	

Table VI. *Shows percentage purity and germination of grasses.*

	No. of samples included in the averages	Average percentage of impurities		Percentage of samples with 1% or over of injurious weed seeds		Average percentage of germination	
		1937-38	1922-37	**1937-38**	1936-37	**1937-38**	1922-37
Perennial Ryegrass ...	1031	**2·92**	2·94	**9·3**	3·5	**83·4**	83·4
Italian Ryegrass ..	411	**3·37**	2·74	**15·5**	8·0	**81·9**	83·3
Cocksfoot	238	**9·77**	9·78	**2·1**	0·4	**89·1**	89·1
Timothy .. .	189	**0·90**	1·36	**1·1**	2·5	**89·0**	89·3
Meadow Fescue	64	**0·70**	2·37	**3·1**	7·2	**85·3**	84·4
Crested Dogstail .	222	**2·21**	3·44	**4·9**	0·8	**87·9**	82·1

Other grasses not scheduled in the Seeds Regulations, 1922.

		1937-38	1936-37		**1937-38**	1936-37
Hard Fescue .	187	**8·2**	9·0		**84·9**	86·2
Tall Oat Grass	9	**6·7**	4·5		**76·6**	87·0
Agrostis spp. .	116	**7·7**	6·9		**90·2**	91·6
Brown Top	139	**4·3**	17·4		**87·8**	87·4
Meadow Foxtail	16	**34·4**	34·6		**56·1**	64·3
Poa trivialis	105	**8·2**	8·9		**84·4**	85·0
Poa pratensis ...	167	**11·5**	12·6		**80·6**	82·8
Poa nemoralis .	18	**11·6**	16·6		**83·9**	81·1
Chewing's Fescue ..	133	**1·7**	1·6		**70·5**	86·4
Sheep's Fescue .	39	**19·3**	23·5		**76·9**	73·0
Tall Fescue ...	18	**3·7**	6·8		**85·2**	89·8
Red Fescue . ..	158	**16·2**	24·6		**87·4**	85·0

Table VII. *Shows percentage purity and germination of clovers.*

	No. of samples included in the averages	Average percentage of impurities		Percentage of samples with 1% or over of injurious weed seeds		Average percentage of germination		Average percentage of hard seeds	
		1937-38	1917-37	**1937-38**	1936-37	**1937-38**	1917-37	**1937-38**	1917-37
Red Clover (All Samples)	2856	**2·92**	3·62	**3·3**	5·3	**79·3**	78·4	**6·8**	5·0
,, ,, (English) .	1093	**2·32**	3·22	**1·9**	3·4	**82·7**	78·9	**9·7**	5·2
,, ,, (Chilean)	36	**0·76**	1·70	**0·0**	0·0	**86·1**	88·5	**5·8**	6·1
Alsike (All Samples) ..	203	**5·22**	4·38	**0·0**	0·0	**84·3**	83·1	**5·2**	6·2
White Clover (All Samples) .	1011	**5·45**	7·09	**4·9**	3·0	**77·3**	73·3	**12·8**	10·9
,, ,, (English)	306	**3·47**	4·81	**2·3**	2·5	**77·5**	81·0	**13·8**	8·1
,, ,, (Mid-European)	111	**3·30**	4·30	**6·3**	1·5	**80·3**	84·5	**7·4**	6·6
,, ,, (New Zealand) ..	45	**1·47**	3·25	**0·0**	0·0	**87·4**	87·4	**5·9**	7·5
Wild White Clover	723	**5·06**	7·84	**2·4**	2·0	**77·0**	74·9	**14·6**	13·4
Trefoil .	471	**1·20**	1·39	**0·8**	0·2	**73·5**	77·0	**4·0**	2·6
Lucerne	55	**1·55**	2·35	**0·0**	0·0	**68·1**	80·4	**5·4**	5·7
Sainfoin	288	**2·69**	3·11	**0·0**	0·0	**73·7**	72·3	**2·3**	0·6
Crimson Clover ...	51	**2·52**	3·19	**0·0**	0·0	**77·0**	80·8	**2·5**	0·5

DODDER IN CLOVER SAMPLES.

In Table VIII is shown the percentage of samples found to contain seeds of clover dodder, for each of the species examined, together with corresponding figures for each of the preceding seasons. In the case of red clover (all samples) and of Chilean red clover, the figures recorded are lower than in any previous season.

Table VIII. *Shows percentage of samples containing dodder.*

	RED CLOVER.					
	All samples	English	French	Chilean	U.S.A.	New Zealand
1937-38	**2·0**	**0·1**	**0·0**	**58·1**	—	**0·0**
1936-37	5·3	0·1	0·0	69·2	0·0	0·0
1935-36	6·1	0·9	—	81·1	6·2	—
1934-35	5·7	2·2	—	90·2	0·0	—
1933-34	6·2	1·6	0·0	95·7	8·0	0·0
1932-33	5·5	0·5	3·8	89·2	14·2	0·0
1931-32	3·6	0·8	0·1	92·0	8·3	0·0
1930-31 ...	2·8	1·7	12·9	91·6	0·0	0·0
1929-30	4·0	1·5	0·0	80·0	33·3	0·0
1928-29	4·9	2·2	14·2	85·0	0·0	14·3
1927-28	8·5	3·4	13·9	86·6	0·0	0·0
1926-27	6·5	3·6	7·3	89·6	0·0	0·0
1925-26	7·2	3·2	9·7	89·1	0·0	25·0
1924-25	10·1	5·3	8·3	94·5	11·1	20·0
1923-24	10·5	5·9	8·0	98·5	0·6	1·4
1922-23	29·4	17·6	8·8	91·7	18·0	23·5
1921-22	21·8	10·2	18·2	83·6	0·0	0·0
1920-21	19·2	4·4	13·4	82·6	30·0	10·0
1919-20	18·9	3·4	15·4	81·1	10·1	0·0
1918-19	27·3	12·1	36·6	90·9	10·1	—

	ALSIKE	WHITE CLOVER.			ALSIKE AND WHITE	LUCERNE
		All samples	Mid-European	New Zealand		
1937-38	**0·0**	**0·0**	**0·0**	**0·0**	**2·2**	**1·8**
1936-37	0·6	0·3	0·0	0·0	2·0	1·4
1935-36	0·0	0·5	1·9	0·0	2·7	3·2
1934-35	0·0	0·4	0·0	0·0	1·0	8·4
1933-34	0·0	0·0	0·0	0·0	1·0	5·1
1932-33	0·0	0·0	0·0	0·0	1·3	6·7
1931-32	0·0	0·1	0·0	0·0	2·4	9·4
1930-31	0·5	1·3	5·1	0·0	5·9	8·6
1929-30	0·6	0·6	4·4	0·0	9·7	8·7
1928-29	1·6	0·1	6·1	0·0	0·7	9·4
1927-28	0·0	0·1	5·6	0·0	0·0	5·9
1926-27	0·0	0·4	2·1	7·1	5·8	5·7
1925-26	0·0	1·5	0·0	12·5	0·0	11·3
1924-25	1·3	5·6	12·9	37·5	2·9	12·5
1923-24	1·0	2·4	0·0	66·6	2·0	11·1
1922-23	4·1	17·6	5·0	48·3	22·2	11·5
1921-22	6·4	4·5	3·5	25·0	7·9	7·3
1920-21	5·5	3·4	12·5	9·4	16·1	12·3
1919-20	6·1	3·1	11·1	0·0	13·6	12·2
1918-19	less than 1·0	1·3	—	—	less than 1·0	6·7

A dash sign, thus —, in this table indicates that no samples were received.

VARIETIES OF CEREALS.

Table IX shows the distribution of cereal samples according to variety. Although the figures recorded in this table are not necessarily correlated with the areas sown with the different varieties, yet they afford some indication of relative popularity. As samples are not infrequently received at the Station bearing no varietal name, two sets of figures are shown for each variety in the table, one giving the percentage occurrence amongst all samples and the other the percentage amongst named varieties only. Only those varieties are included which occur to at least 0·7% of all samples. Compared with the corresponding figures for the two preceding seasons, there is found to be little change in the order of the first few varieties in any group.

Table IX. *Shows distribution of cereal samples according to variety.*

	Percentage of total.	Percentage of named varieties.		Percentage of total.	Percentage of named varieties.
		WHEAT.			
Squarehead's Master and Red Standard	15·7	18·4	April Bearded	2·7	3·1
Little Joss	11·3	13·2	Garton's "60" ...	2·2	2·6
Victor	10·8	12·7	Wilma .	2·2	2·6
Wilhelmina ...	9·9	11·6	Rivetts	1·2	1·4
Yeoman and Yeoman II	5·6	6·5	Renown	1.1	1·3
Red Marvel and Japhet . ..	4·7	5·5	Other named varieties	15·0	17·6
Squarehead II ...	3·0	3·5	Not named ...	14·6	
		BARLEY.			
Spratt-Archer .	20·9	40·0	Archer	1·0	1·9
Plumage Archer ...	13·6	25·9	Maltster . ..	·8	1·5
Plumage	5·6	10·6	Chevalier	·8	1·5
New Cross ..	2·5	4·8	Standwell . .	·7	1·4
Golden Archer ...	2·4	4·6	Other named varieties	3·0	5·8
Plumage "63" .	1·1	2·0	Not named . ..	47·6	
		OATS.			
Victory	18·1	22·3	Star	3·9	4·8
Marvellous ...	11·7	14·5	Black Tartarian ...	3·8	4·7
Abundance ...	6·7	8·3	Yielder	2·4	3·0
Grey Winter ...	6·0	7·4	Golden Rain and Golden Rain II ...	2·1	2·6
Onward	5·8	7·2	Superb	1·3	1·7
Black Winter ...	5·3	6·5	Other named varieties	8·9	11·0
Supreme	4·8	6·0	Not named ...	19·2	

SEED-BORNE PLANT DISEASES.

A. Diseases of Cereals.

The routine examination for impurities, in the case of cereal samples, includes noting and reporting the presence of certain seed-borne plant diseases, where evidence of infection can be determined by " naked-eye " examination only. Figures showing the percentage of samples with " naked-eye " evidence of infection are given in Table X, together with comparable figures for the preceding season. The cereal samples examined during the season under review would have been derived almost entirely from the harvest of 1937. Both in the case of bunt and of earcockles, the percentage of infected wheat samples is lower than in any preceding season. The percentage of barley samples found to contain smutted grain is higher than in any season since 1930-31 and the percentage of rye samples containing " ergots " is the highest for eight years. Where ergot was found to be present in samples, the actual quantity per infected sample was small and in most cases constituted only a " trace ".

Table X. *Shows percentage of cereal samples with " naked-eye " evidence of disease infection.*

	1937-38 per cent.	1936-37 per cent.
Bunt in Wheat—*Tilletia Caries* (D.C.) Tul.	2·0	2·7
Earcockles in Wheat—***Anguilulina tritici*** Gervais and Beneden ...	0·8	1·5
Ergot in Wheat—*Claviceps purpurea* (Fr.) Tul.	0·9	1·3
Smut in Barley—*Ustilago Hordei* (Pers.) Kellerm. and Swing ..	7·1	4·6
Ergot in Rye—*Claviceps purpurea* (Fr.) Tul.	23·8	19·3

B. Diseases of Celery.

41 samples of celery seed were submitted for special examination for the presence of *Septoria Apii. Chester.* (Celery leaf spot or blight) and these samples were also examined for *Phoma apiicola. Kleb.* (Phoma root rot). Table XI shows the number and percentage of samples falling within certain limits of infection, as determined from the presence of pycnidia upon the " seed ".

Table XI. *Shows number and percentage of celery seed samples infected with Septoria Apii and Phoma apiicola.*

Range of Infection per cent.	*Celery Leaf Spot.*		*Phoma Root Rot.*	
	Number of samples.	No. of samples as percentage.	Number of samples.	No. of samples as percentage.
Nil	9	21·9	23	56·1
1-5	15	36·6	14	34·1
6-10	4	9·8	4	9·8
11-20	5	12·2		
21-30	—	—		
31-40	2	4·9		
41-50	1	2·4		
51-60	—	—		
61-70	5	12·2		

C. General.

Enquiries were received during the season concerning various seed-borne diseases and a number of samples were submitted for examination for the presence of specific pathogenic organisms.

Sclerotia separated during the season from a few red clover samples were identified as of *Sclerotinia trifoliorum. Erikss.*

MOISTURE CONTENT OF SEED SAMPLES.

The number of samples submitted for moisture content determination was higher than in any previous year, the total reaching 343, made up as follows :—

Sugar Beet	134
Wheat	100
Flax	97
Swede	6
Mangold	4
Peas	1
Turnip	1

WILD WHITE CLOVER CERTIFICATION SCHEME.

Plots from twenty-eight " head " samples, which had been collected from fields inspected under the scheme during the summer of 1937, were sown down in September and the Plot Inspection Committee—a special committee set up under the scheme—examined and reported upon these plots in July, 1938. Plots of this nature have been sown down each year since 1930 and the total number up to July 1938 amounts to 942. Type samples from pastures which have been finally certified, are also received by the Station and plots are sown down from these for checking purposes; 128 such plots have now been sown. The total of all plots sown down in connection with the scheme has now reached 1070.

SEED TESTING COURSE.

A course of instruction in the theory and practice of seed analysis was held at the Station from the 20th June to the 20th July 1938, the last two days being devoted to practical and written examinations. Twenty analysts attended the course, including six members of the Station's own staff, and an additional candidate attended for the examination only. Of the twenty-one candidates taking the examination, seventeen were successful in both theory and practice and thus qualified for the certificate of proficiency awarded to successful candidates. Three analysts satisfied the examiners in practical work only and one failed altogether.

SEED ANALYSTS' CONFERENCE.

The Eleventh Conference of Seed Analysts was held at the National Institute of Agricultural Botany on the 21st July, under the chairmanship of Dr. R. N. Salaman. Representatives from twenty-nine seed firms attended the conference and in addition there were present representatives of the Ministry of Agriculture, the Department of Agriculture for Scotland, the

Ministry of Agriculture Northern Ireland and members of the Official Seed Testing Station staff. The various items upon the agenda provoked useful and interesting discussion and a full report of the conference has been given in Seed Analysts' Bulletin No. 31, published by the Ministry of Agriculture for circulation amongst the private seed testing stations licensed by the Ministry.

INVESTIGATIONS.

As mentioned earlier in this report, routine investigations necessitated the conducting of 2,055 tests during the season.

Arising out of the work undertaken by the Station in connection with the Wild White Clover Certification Scheme, investigations are in progress to determine the value of the so called " Picric Acid " test as a means of determining the genuineness of stocks of wild white clover, special attention being directed to the possibility of correlating strength of reaction to the test with type of wild white clover plant as judged from field trials.

GENERAL.

An increasing demand has been made upon the services of the Station in determining the percentage of fluorescing individuals in samples of ryegrass seed. The number of seed samples submitted for identification reached a high level and in addition, many plant specimens were received, the majority being of grass species. A number of requests were received for material demonstrating various seed-borne diseases and for seed samples for educational purposes, and in most instances the Station was able to supply the material asked for.

MEETINGS OF THE FELLOWS OF THE INSTITUTE

SEVENTEENTH ANNUAL GENERAL MEETING.

The Seventeenth Annual General Meeting of Fellows of the Institute was held at Cambridge on the 21st July, 1938.

Dr. R. N. Salaman, J.P., M.D., F.R.S., Chairman of the Council, who presided, submitted the Eighteenth Annual Report of the Council and the accounts for 1936-37, and they were unanimously received.

An address—which is printed below—was given by the Chairman on " Potatoes—a Retrospect, 1918-1938 ". Before giving this address, however, the Chairman made the following reference to the late Director of the Institute, Mr. W. H. Parker, who died on the 11th January, 1938.

The distinguished part Parker played as a soldier in the Great War and the position he held from schooldays till his death as athlete and sportsman have been recognised elsewhere.

To-day we think of Parker as our first Director and the man under whose guidance and control our Institute has attained a position of first-class importance in the agricultural life of this country. Whilst Parker would be the first to recognize that the stimulus and energy which has brought about this happy result is essentially due to the co-operation of his co-workers on the Council and on the staff with himself, we have long realised that without Parker's supreme gifts of understanding, patience and tact, our united efforts would have been in vain.

As one who worked continuously with him for 18 years, enjoying often an almost day-to-day contact, I do appreciate how faithfully he tried and how greatly he succeeded in adapting himself to the service of the Institute.

And remember Parker had no easy task. We owe our foundation to one of the most brilliant and energetic men which England threw up in the War, Sir Lawrence Weaver. This Institute was the child of his creation and the central interest of Weaver's life for the next five years. Parker, a young man of 30, had been appointed to the Directorship; his youth, inexperience and his respect for authority all tended to hide his own capacity for administration and initiative behind the all-powerful personality of Weaver. Then came a dramatic break in our history and in his : Weaver gave up the reins of government; for Parker the day of trial had dawned. It was a difficult moment, for not only Parker but the whole staff had become set in its attitude of dependence on the wisdom and guidance of one man.

It took a little time for the readjustment to establish itself and become stabilised. The difficulties were great but one by one, and not without struggle

and personal sacrifice, did Parker overcome them. It was not long before Parker showed that he possessed not merely that physical courage we were all aware of, but a sense of moral strength and a capacity for industry which, allied to his quick and adaptive mentality, gave him a mastery of the situation. The outstanding achievement of Parker's all too short life was this deliberate moulding of his own character, the successful adaptation of a physical and cultural training which, had it been allowed to take its natural course, would have made him pre-eminent in the world of sport was, in fact, dedicated to the silent service of a great national interest.

Indeed we may say that Parker's career was in itself an epitome of much that is estimable in the English Public School tradition, a tradition which to-day must adapt itself to new conditions, or decay. Parker in his own life went far towards achieving a synthesis of the old and the new.

POTATOES: A RETROSPECT

1918 - 1938

REDCLIFFE N. SALAMAN, M.D., F.R.S.

The National Institute of Agricultural Botany's first entry into the potato world was in 1919 when it took over from the Ministry of Agriculture the testing for susceptibility to wart disease which had been carried on at Ormskirk in the grounds of the local workhouse. Snell, who in co-operation with a number of Ormskirk farmers had initiated the trials, continued in charge, and remained on the staff of the Ministry of Agriculture. Miss Johnston, who later became Mrs. Snell, joined his staff in 1918 and remained with him until his death in April, 1920, when the trials were taken over by Bryan, who as a Horticultural Inspector of the Ministry, had gained some experience of the work in the previous year. Miss Whitehead, later Mrs. McDermott, Snell's clerical assistant, accompanied Bryan as his secretary and assistant, and both these officers were transferred from the Ministry to the staff of the Institute towards the end of 1920. Happily both Mrs. McDermott and Bryan are with us now and to them belongs most of the credit for the valuable work which has been accomplished in the last two decades. In 1919 the workhouse grounds were given up and the Institute bought a farm of 40 acres on which all its trials have been conducted.

The work of the Institute has touched the Potato Industry at many points and I propose to traverse these and then attempt to evaluate the results and indicate the conclusions which I think should be drawn from them :

1. *Testing for immunity and susceptibility to wart disease;* this has resulted in the following :—

(a) The potato population of Great Britain has been separated into a wart susceptible and a wart resistant group. By testing small samples rapidly and free of cost, we have assisted the breeder in his efforts towards raising only immune varieties.

(b) The inspection by the Synonym Committee, and in particular the Superintendent's critical examination of seedling varieties, has led to a rapid elimination of useless aspirants and, as a consequence, brought about notable changes in the characteristics of modern varieties. Purple-tubered varieties have been practically eliminated; only smooth-eyed tubers are favoured; whilst irregular lumpy-shaped tubers, long stolons and abundant fibrous roots are taboo. At the same time, and perhaps with less good reason, vigorous, many-stemmed plants with an upright habit and plants with hairy foliage have been discouraged.

2. *The Synonym Problem.*

The N.I.A.B. took over this work which Snell had instituted under the auspices of a Committee of the Royal Horticultural Society and pursued it vigorously. To-day we may say that this problem has been solved. The magnitude of the task will be apparent when I remind you that when we took over Snell's work 75% of all entries at Ormskirk were merely synonyms of existing varieties, whilst to-day the percentage is 2% or less. A far more difficult task was it to persuade Seedsmen to eradicate synonyms, incorrect descriptions and the like from their catalogues. That battle also has been waged and won, and if most of the brunt of the struggle fell on me, it may be a comfort to some to note that though the din of battle was great and loud, the wounds on either side have entirely healed. To-day we can say with some pride that the Potato Trade both in regard to quality and identity of the seed they sell has no need to fear comparison with the sellers of any other agricultural product.

3. *Yield and Maturity Trials of Potato Varieties.*

We have conducted a very large number of carefully planned and statistically controlled trials of potato varieties with the object of determining their relative merits in regard to yield and maturity. A selection of the results is to be found in our Farmers Leaflet No. 3, Ed. 1936, but the time is ripe for a new and fuller consideration of these results, which I hope may be undertaken in the near future. As a result of this calibration of our varieties, we can obtain an accurate conception of the yield and maturity of a new seedling by a direct comparison with a single control from the tested series.

4. *The recognition of and protection against Virus Diseases.*

If there is one claim before all others which the N.I.A.B. can make, it is that they have been in the forefront of those who have succeeded in making the potato growers of this country " virus minded ". Twenty years ago the knowledge of such troubles was as small as the damage they caused was great. To-day we are beginning to see this relation corrected. Credit is especially due to Mr. Bryan, who, by large scale demonstration, has shown that the farmer who has, say 50 or more acres at his disposal and the necessary knowledge and keenness, can raise his own seed and maintain it in a very fair state of health over a number of years, and this by the means of simple isolation and the necessary intelligence. Bryan's experiments are confined to Ormskirk; I have shown that it can be done but not so easily in the Eastern Counties. Farmers have the choice of either growing under very special conditions their own seed or buying it from Scotland or elsewhere. In regard to the latter, very many farmers have yet to learn that there is nothing magical in the word " Scotland "; that both very good and very indifferent seed may be bought at the same price from the same district. This year we have instituted a trial in Bedfordshire under Mr. Brandreth which should bring this home very clearly to the farmer. This trial is one in which I am personally very interested: we have procured samples of the actual seed purchased by the farmer from Scotland or elsewhere and planted it out, noting the amount of virus disease present. We have confined ourselves to two varieties only this year and have secured 56 samples. What is important

to remember is that three-quarters of the potato acreage of England is sown with once and twice-grown seed and that in most years 30%—50% is suffering from severe virus infection. It is probably an understatement to say that we are losing one million tons a year as a result of this policy alone.

In the main, the problem of virus infection turns on the effect produced on any particular variety by one or other of two viruses, viz., that of Leaf Roll and that of Leaf Drop Streak, or Y; to neither is any variety immune. To Leaf Roll scarcely any variety is even fairly tolerant, though Great Scot and Up-to-date are more so than others. To the attacks of Y, varieties differ considerably: President, Majestic, Kerr's Pink and Up-to-date are very susceptible; King Edward rather less; Arran Victory, Great Scot and Abundance still less so; whilst Ulster Monarch and Edgecote Purple are almost tolerant. Under our present methods we might, though it is very improbable, breed some variety still more tolerant, but it is practically certain that we shall never create a variety immune to the Y virus. At the present time the key to the agricultural side of the potato problem can be summed up in two words — CLEAN SEED.

5. *New Varieties: The Lord Derby Gold Medal.*

The N.I.A.B. has been responsible for the Lord Derby Gold Medal Trials whose object is to encourage the production of new wart-immune varieties.

Forty-four distinct varieties have been passed through these trials and twelve awards have been made since the N.I.A.B. took over control. Prior to this, six awards were made. There are eighteen Gold Medal Varieties in all.

A study of the distribution in Great Britain of varieties as classified by the Potato Marketing Board for 1937 constitutes a caustic if unconscious comment on the united wisdom of the special committee which makes these awards. This body consists of a number of South-West Lancashire potato growers and three members of the Institute. I have been a member for all these years and must bear full responsibility. Of the eighteen Gold Medallists Kerr's Pink, Arran Banner and Arran Pilot are the only three which command an acreage of any importance in the fields of Great Britain, the first outnumbering the last by 9 : 1. The question of the varieties most in request is one of much interest and its consideration may have an important bearing on future policy.

In Tables I, II, and III are set out in detail the percentage of the acreages under potatoes in Scotland (the seed producing area), in Lincolnshire (the ware producing area), and in England, Wales and Scotland together. The figures have been extracted from the Potato Marketing Board's Return for 1937, where they are arranged in three main groups, viz., Earlies, Second Earlies and Maincrops. I have analysed each of them in respect to the percentage of the total area under Gold Medallist varieties, Other Wart-Immune varieties, and the old Susceptible varieties. Table IV is a summary of the first three. Examining Table IV we find in respect to First Earlies there is no important difference between the three areas. All agree in demonstrating that there is no immune First Early which appreciably threatens the sway of the old susceptible ones, but that the Gold Medallists have outdistanced all other immunes, which is not saying much.

In regard to the Second Earlies, Scotland and Great Britain as a whole agree closely. In Lincolnshire, however, we find a very striking departure: Immunes are down to 13% and Susceptibles up to 83%. This difference is due to the fact that Lincolnshire grows Eclipse instead of Great Scot as its chief Second Early. Why this should be it is not easy to answer: in part, no doubt, it is due to habit which has grown into a local tradition, for once a particular trade channel has been established it is difficult and sometimes disadvantageous to change it. However, there can be no question in my opinion as to which is the better variety to grow from a purely national economic point of view and that is Great Scot. I will return to the point later.

The maincrop returns show that our seed and ware areas exhibit very distinct patterns of behaviour as regards the type of variety they favour. Let us look first at the great ware producing district: here the producers have no use for any of our Gold Medallists but divide their acreage between a 27 year old immune, Majestic, and a 36 year old susceptible, King Edward, in the proportion of about 6 to 4. That they have good reason for this needs little argument: Majestic is an excellent chipping potato and a serviceable one for domestic use. King Edward is a potato which in addition to its good cooking quality, has one positive and nearly unique virtue, namely that it undergoes less discolouration on keeping after boiling or on reheating than any other, but for the rest its face is its fortune and this secures it an increased price of £1 per ton. Lately it has met with a rival which uses the same pink and white make-up and is an immune in the bargain; King Edward's position should be threatened though there is little sign of such at present. The rival I speak of is "Gladstone": it received the Gold Medal in 1935 but seems scarcely to have recovered from the shock.

Scotland takes a quite different view on the Maincrops: she devotes nearly half her area to the Gold Medallists. The reason would seem to be twofold: Firstly, Scotland is the home of sound common-sense which, when it does not conflict with the sacred duty of money-making, is allowed full sway. The Scotchman wants for his own table a really good mealy potato which he knows, as we do not, how to cook; he demands a variety which is relatively cheap and the small farmer and crofter needs a potato which will grow on poor, rough soils. Such a variety is Kerr's Pink and the wise Scotchman has taken it to his own heart. Then comes the question of business: to Scotland we look for much of our best seed and it is their business to grow newly introduced varieties or any other for which a high price can be obtained, and they do, but their being grown in Scotland must not be taken as evidence of their worth. Hence also the anomaly that Scotland devotes 9% of her Maincrop area to Golden Wonder, a feeble-cropping potato sodden with virus, to which neither Cambridge nor Lincolnshire will give an acre, but which obtains a fancy price on its reputation as a table variety. It is only fair to add that most of it is consumed in Scotland.

To what conclusion, it will be asked, does our survey of the Potato Variety problem lead us? The answer can neither be a single one nor one which will meet with general agreement. The problem, however, is urgent and I for one feel that it cannot be birked. It will perhaps be easier if one poses definite questions and attempts to answer them:

Why have the Gold Medallist varieties failed to secure a substantial footing in the country?

There are three main reasons :

(1) None is significantly superior to the older varieties; in the first-early group there is only one serious competitor, Arran Pilot, and that is not so reliable as the best of the old susceptibles. Moreover, in the first-early group, wart immunity has some, but no great economic value, nor will it have, so long as the Ministry allows susceptible first-earlies to be grown in warted areas.

(2) Except in scheduled areas there is no clamant reason why producers should replace susceptible varieties in which they have long had confidence and know where to market, for new varieties which have no superiority over them except their immunity. In the maincrop group, there are very serviceable immunes which are not Gold Medallists, such as Majestic.

(3) Custom hardens rapidly and develops into a tradition in our countryside; a new variety even with the imprimatur of the Gold Medal has an uphill fight against old favourites.

Is there any reason to believe that Potato raisers will produce in the near future varieties in any of the maturity groups which will sweep away their predecessors?

I believe there is not the slightest ground for such a belief. I have in an article published in the Gardener's Chronicle, Oct. 30, 1937, given at some length my reasons for this view. Briefly it is that breeders have refined down their parental stocks to such a degree that the chance of producing anything appreciably better is genetically impossible. Somewhere between 1890 and 1910 we had brought to the fore and embodied in our varieties most of those qualities which the trade — I intentionally do not include the consumers — demanded. I do not say they got all. Neither resistance to degenerative disease nor immunity to blight have been vouchsafed to them; nor are they ever likely to be under the present dispensation. In saying this, I am by no means unmindful of the splendid work of such men as Mr. McKelvie and Mr. Watson of McGill & Smith, but when one looks back on their untiring efforts to produce immune varieties to replace existing susceptibles, one is forced to realise that only Arran Pilot and Doon Star (which latter did not get the Gold Medal) show any promise of making good, though the future of neither is by any means assured.

To make a further advance new methods are necessary. We must build into our breeding stocks blood from sources hitherto untapped. I speak of wild and not always related tuber-bearing species of Solanums. Considerable progress along these lines has been made in Russia and in Cambridge but, so far, the Potato Industry has not shown the remotest interest in the matter.

Is the present condition of the Potato Industry one best adapted to serve the nation's vital interest in event of war?

To this I would answer " No ", but would add that it could be so adapted within a relatively short period.

War conditions demand that our returns per acre shall be the highest possible. To ensure that, we need the following conditions:

(1) *Virus-free seed in large quantities.*

Such is not available and what little first-class seed is available is not distributed to the best advantage of the nation. Thus first-class stock seed which is relatively virus-free should never leave the seed-producing areas as it does to-day. It should be employed, as Mr. Brandreth has represented to me, exclusively in raising more and more seed in those areas where the chance of virus infection is reduced to a minimum. Maintenance of an adequate acreage in suitable districts devoted solely to the raising of virus-free seed should be regarded as an essential war measure brooking no delay.

It is further of importance that the public should recognize that the Ministry's certificates which accompany seed potatoes guarantee purity of stock only, leaving the health of the stock out of consideration and thus are liable to create a false sense of security.

Absolutely virus-free seed which has been isolated and maintained at the nation's expense is to be found only at Cambridge but is at present entirely neglected. It should be multiplied in appropriate areas and used to renew our best Scottish and Irish seed stocks. A scheme for such was supplied to the Potato Marketing Board in 1934 but is still reposing in its pigeon-holes. The loss due to virus-infected seed in England has already been referred to as being in the neighbourhood of one million tons per year.

(2) *The varieties grown in the ware districts should be those which tolerate virus infection and frost best.*

In the first-early group these are probably Epicure and Duke of York. In the second-early group Great Scot stands pre-eminent; it is probably the best all-round potato ever produced. In the maincrops Kerr's Pink is probably the best food producer under all conditions, and Arran Banner a close second; these two would produce more food to the acre than either King Edward or Majestic. Indeed, the continued cultivation of King Edward in war time would be a serious mistake. Its replacement by a heavy cropper such as Arran Banner would alone increase our annual total output by something like 300,000 tons.

We cannot leave this aspect of the subject without saying a few words about the Potato Marketing Board, a body created in 1934 which exercises an autocratic control over the potato acreage and the methods of wholesale marketing, thus acquiring a position of great importance in the national economy. I have no desire to enter into a detailed criticism of the Board's work, much of which I believe to be excellent. There are, however, aspects of its activities which in my opinion do not serve the best interests of the nation.

In a word, the policy of the Board is to restrict acreage, without taking steps to increase the tonnage per acre, and tends to confuse the cash value of a restricted crop with the true economic value of the product as a food of the people. Thus I am assured that to working-people generally as well as those whose income is as much as £250 per annum, potatoes are not worth more than 10d. a score for deep-eyed varieties and 1/- per score for smooth ones. In other words, the retail price to the consumer should not be above £4 13s. 4d. per ton for the one and £5 12s. 0d. for the other. At these prices the producer might expect to obtain about £3 10s. 0d. and

£4 10s. 0d. respectively. If I am told that at this figure the farmer could not produce at a profit I would answer that the cure is in his own hands, viz., a heavier tonnage on a smaller acreage, say a minimum of 10 tons of serviceable ware in the good potato districts. I would go further and remind him that the poor are potentially the heaviest consumers and by providing them with potatoes at a reasonable figure one is not only increasing the market outlet but performing a work of national importance.

At the present moment the impression is rife that the Board's policy is calculated to maintain a high price in the interest of the producer rather than to encourage a greater consumption at a lower price in the interest of the consumer. That such an interpretation should be entertained is unfortunate; were it to be true, it would be deplorable.

Some of these complaints might be rectified in the hour of emergency; what cannot be, is the Potato Marketing Board's neglect to build up the largest possible area devoted to clean seed production. The Board should have as its ideal the production in England of an average crop of at least 8 tons per acre instead of something like 6, and the maintenance of high quality seed and heavy yielding varieties so that in time of need the total crop could be indefinitely increased.

(3) *We should strive to create blight-resistant varieties.*

Blight is one of our greatest enemies and so far we have not even one partially resistant commercial variety. The work at Cambridge has gone a long way towards remedying this; it should be pushed forward in the national interest as rapidly as may be.

In this connection it should be noted that we are gathering together in Cambridge an Empire collection of American species and varieties, some of which possess a high degree of resistance to Phytophthora infestans. These have been placed under my care and I shall be delighted to let those who are seriously engaged in potato breeding have samples.

To sum up: Britain is an ideal place for the production of a maximum tonnage to the acre of good potatoes, and, virus and blight-resistance apart, we have the best and most suitable varieties ready to hand. What we immediately need is the scientific organization of the industry regarded as a whole, i.e., from the production of seed at one end of the scale to the dish of potatoes on the table at the other. And this, not as hitherto mainly in the interests of the producer, but to a much greater extent in that of the consumer. Above all, we must realise that virus disease and blight cost the nation about five million pounds per year; that loss caused by the former could to-day be largely avoided by the proper organization of the seed trade, and further research might well cancel out the latter in five to ten years. Between them, these constitute a serious gap in our armament. I would suggest that the Industry in the person of the Potato Marketing Board should without delay consider these matters and, in particular, should support research against the blight scourge which has ravaged our fields for nearly 100 years and has cost the nation many hundreds of millions. Corporate organization entails national responsibility. Individuals by their own lapses may suffer from hunger and misadventure but if our controllers are without vision the whole people perish.

TABLE I.

An Analysis of the acreage under Potatoes in Scotland in 1937.

FIRST EARLIES :			
Total acreage of named varieties	17,164	acres.	
Immune Gold Medallists (Arran Crest 39; Arran Pilot 963)	1,002	,,	= 6·0%
Other Immune varieties (Ballydoon 174; Di Vernon 51; etc.)	279	,,	= 1·6%
Old Susceptible varieties (Duke of York 1,248; Eclipse 2,316; Epicure 9,421; Sharpe's Express 2,256, etc.)	15,883	,,	=92·4%
SECOND EARLIES :			
Total acreage of named varieties	9,875	,,	
Immune Gold Medallists (Ally 167, Arran Comrade, 97)	264	,,	= 2·7%
Other Immune varieties (Catriona 130; Great Scot 6,387; King George 153; etc.)	7,039	,,	=71·3%
Old Susceptible varieties (British Queen 1,999; Royal Kidney 573)	2,572	,,	=26·0%
MAINCROPS :			
Total acreage of named varieties	81,791	,,	
Immune Gold Medallists (Arran Banner 2,640; Arran Consul 524; Gladstone 293; Kerr's Pink 34,022, etc.)	38,830	,,	=47·5%
Other Immune varieties (Golden Wonder and Langworthy 7,049; Majestic 16,909; Doon Star 4,450, etc.)	29,199	,,	=35·7%
Old Susceptible varieties (Up-to-Date & Field Marshal 646; King Edward 11,395, etc.)	13,762	,,	=16·8%

TABLE II.

An Analysis of the acreage under Potatoes in Lincolnshire in 1937.

FIRST EARLIES :			
Total acreage of named varieties	15,151	acres.	
Immune Gold Medallists (Arran Pilot 635; Arran Crest 66)	701	,,	= 4·62%
Other Immune varieties	43	,,	= 0·28%
Old Susceptible varieties (Duke of York 2,703; Eclipse 8,593; Epicure 230; May Queen 171; Sharpe's Express 2,698)	14,407	,,	=95·10%
SECOND EARLIES :			
Total acreage of named varieties	1,647	,,	
Immune Gold Medallists	65	,,	= 4·0%
Other Immune varieties (Great Scot 205, etc.)	214	,,	=13·0%
Old Susceptible varieties (British Queen 110; Royal Kidney 1,258)	1,368	,,	=83·0%
MAINCROPS :			
Total acreage of named varieties	88,150	,,	
Immune Gold Medallists (Gladstone 330; Arran Banner 173, etc.)	563	,,	= 0·7%
Other Immune varieties (Doon Star 5,851; Majestic 49,839, etc.)	55,775	,,	=63·3%
Old Susceptible varieties (King Edward 30,930; Up-to-Date and Field Marshal 84)	31,812	,,	=36·0%

TABLE III.

An Analysis of the acreage under Potatoes in England, Wales and Scotland in 1937.

FIRST EARLIES :			
Total acreage of named varieties	75,103	acres.	
Immune Gold Medallists (Arran Crest 248; Arran Pilot 5,740, etc.)	5,988	,,	= 8·0%
Other Immune varieties (Ballydoon 347; Di Vernon 816)	1,255	,,	= 1·7%
Old Susceptible varieties (Duke of York 4,723; Eclipse 26,550; Epicure 15,488; May Queen 2,056; Ninetyfold 10,474; Sharpe's Express 8,494)	67,860	,,	=90·3%
SECOND EARLIES :			
Total acreage of named varieties	28,763	,,	
Immune Gold Medallists (Ally 775; Arran Comrade 246)	1,021	,,	= 3·5%
Other Immune varieties (Catriona 383; Arran Luxury 299; Great Scot 20,055; King George 702, etc.)	21,753	,,	=75·7%
Old Susceptible varieties (British Queen 3,039; Royal Kidney 2,950)	5,989	,,	=20·8%
MAINCROPS :			
Total acreage of named varieties	105,818	,,	
Immune Gold Medallists	80,438	,,	=20·0%
Other Immune varieties (Doon Star 20,885; Golden Wonder 7,071; Majestic 167,736, etc.)	198,062	,,	=49·0%
Old Susceptible varieties (Arran Chief 2,295; Up-to-Date and Field Marshal 2,273; King Edward and Red King 122,689, etc.)	127,318	,,	=31·0%

TABLE IV.

PERCENTAGE OF POTATO ACREAGE OCCUPIED.

		Scotland	Lincolnshire	Gt. Britain & Scotland
FIRST EARLIES :				
Gold Medallists	...	6·0	4·6	8·0
Other Immunes	...	1·6	0·3	1·7
Old Susceptibles	...	92·4	95·1	90·3
SECOND EARLIES :				
Gold Medallists	...	2·7	4·0	3·5
Other Immunes	...	71·3	13·0	75·7
Old Susceptibles	...	26·0	83·0	20·8
MAINCROPS :				
Gold Medallists	...	47·5	0·7	20·0
Other Immunes	.	35·7	63·3	49·0
Old Susceptibles	.	16·8	36·0	31·0